Peter Dobson

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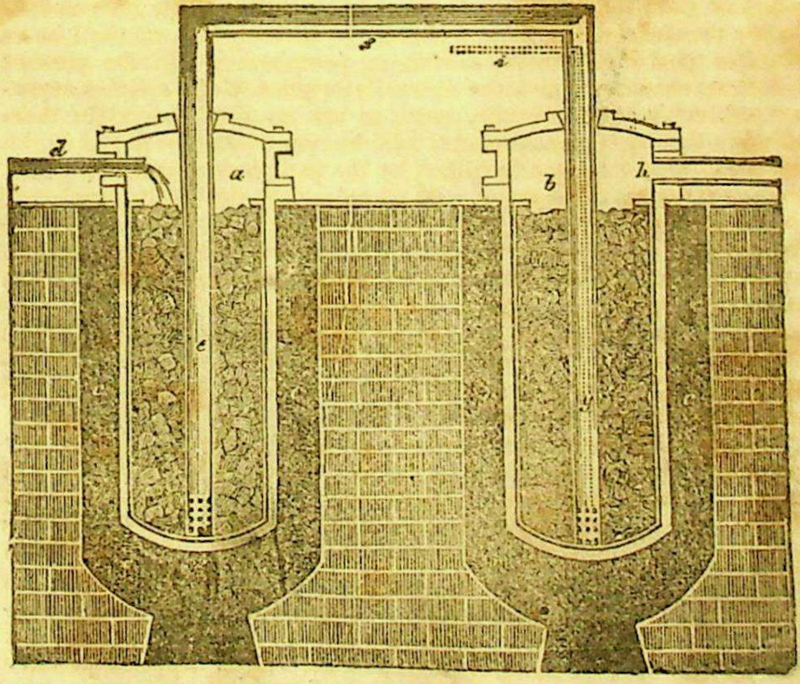
THE FRANKLIN JOURNAL, AND AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

DECEMBER, 1827.

A Description of various apparatus employed in the preparation of Gas, for the purpose of illumination, for which patents have been obtained in England.



Description of TAYLOR'S *Patent Gas Apparatus.*

WE have procured cuts of a variety of apparatus recently patented in England, and purporting to be improvements in the mode of preparing, or supplying, gas, for the purpose of illumination. As experience has demonstrated that gas lights may be advantageously substituted for the former methods of obtaining artificial light in a greater number of cases, and particularly in cities, and in many extensive manufactories, the subject has become one of high interest. New York and Baltimore already enjoy the benefits of this improvement; and we apprehend that Philadelphia will not long lag in the rear, that hyper-prudence, which is thought to be one of her characteristics, to the contrary notwithstanding.

We shall continue to furnish an account of all the improvements made in the gas works in England, or elsewhere; as we may thereby aid in preventing that wasteful expenditure in other places, which marked the establishment, and early progress, of the Baltimore works. It is high time for us to dismiss that vanity which has, in many instances, more than doubled the cost of public undertakings, the vanity of making them American, and which has commonly ended in our being compelled to adopt the modes which the experience of other countries had proved to be best; a procedure which a little sober good sense would have suggested in the first instance.

We shall hereafter give a concise history of the origin and progress of gas illumination, and also some account of the instruments in use previously to those now presented; in doing this, we shall be as brief as possible, without sacrificing perspicuity. In the present instance, we merely give the direct description of the articles represented, with such remarks, only, as are required to explain them clearly; this, we have no doubt, will be universally preferred to the extended specifications furnished by the patentees, and which would cover too many of our pages. With respect to the merit of either of the plans proposed, excepting where we have been informed of the results from actual experience, our readers must not always look to us for an opinion; although, we shall freely present whatever views may appear to us pertinent.

On the first page of this number, we have given a section of Taylor's Gas apparatus, which is adapted for the distillation of liquid substances only, or such as may be rendered liquid by being heated previously to their introduction.

When the liquid matter introduced into the retorts is of easy decomposition, one distillation of it, through a single retort, will, in general, be sufficient to separate the gas in a tolerably pure state. When, however, they are such as require a longer process, the gaseous products of the first distillation are passed into a second retort, to complete the separation of the contaminating matter. As many as ten retorts, similar to those shown in the engraving, may be conveniently arranged over one furnace. In the case of a single distillation, it is, therefore, to be understood that these are all supplied at once with the fluid matter, and the product of each respective retort, is carried from it directly to the gas-holder: but when a second distillation is necessary, the ten retorts before mentioned would be employed as five pair; and the diagram is drawn so as to show the operation either by a single, or by a pair of retorts, which we shall now explain.

The figure gives a vertical section of two cast iron retorts, *a* and *b*, fixed over a furnace constructed with fire bricks; their length may be estimated at about four feet; their form is cylindrical, with covers accurately fitting their necks, so as to render the vessels air tight when they are luted on, and fastened down by keys or screws. They are placed or suspended erect in the brick work, by resting on their projecting flanches, leaving open spaces around them, as at *c c c c*, by which very extended surfaces are exposed to the immediate action of the fire.

Within each of the retorts, a casing or shell of wrought iron is placed exactly fitting the interior; these are filled with fragments of bricks, stones, coke, metal, or any substance that will bear a red heat without fusing; and as these materials frequently require shifting, each case is provided with ears, rings, or lugs, for the convenience of drawing them out of, or letting them down into, the cast iron retorts. Vertical tubes, *e g*, are placed in the centre of each retort; these are connected at their upper ends by the horizontal tube *f*, and passing through the covers, their other ends descend to the bottoms of the retorts, where they are perforated with holes, as shown in the figure. The internal cases, previously empty, are then filled with the broken bricks, and various substances, as before mentioned, and the covers and joints being all properly luted and secured, the retorts are exposed to the action of the fire until the materials acquire a red heat. Thus prepared for the operation, the fluid to be distilled is allowed to flow through the pipe *d*, in small quantity, into the retort *a;* here, falling upon the red hot materials, the process of decomposition commences, which is assisted by the filtration of the liquid through these substances. Having arrived at the bottom, the gaseous portion passing through the perforations, rises up the tube *e*, from thence proceeding along the branch *f*, it descends into the second retort *b*, by the pipe *g*, and passing out again through the holes at the bottom of *g*, the gas re-ascends among the ignited materials, being purified in its progress, until it arrives at the tube *h*, which conducts it to the gas holder.

When the whole operation consists in a single distillation in one retort, the fluid is introduced by means of a pipe *i*, shown by the dotted lines. In this case the tube *g*, does not extend higher than the cap of the retort, in the centre of which the pipe enters, and passes down the middle of the tube *g*, to within six inches of the bottom; from thence, the liquid, flowing through the perforations among the red hot materials, becomes quickly decomposed, and the resulting gas, filtering as it ascends, reaches, in nearly a pure state, the tube *h*, which conducts it, as in the former case, to the gas holder.

It will be noticed, that the substances in the second retort are in larger fragments than those in the first, which is an arrangement found to be advantageous, and therefore recommended by the patentee in his specification. In operating by single distillation the largest fragments are to be thrown into the retort first, with the smaller on the top, which is a disposition similar, in effect, to the former.

Cast-iron is not considered by the patentee as the essential material for the construction of the retorts; they may be made of fire clay, and various other substances; but a preference is given to cast-iron as the most economical and convenient. There is, likewise, no particular material specified for the production of gas, the apparatus being considered alike applicable to the distillation of *all* fluid matters from which carburetted hydrogen may be obtained.

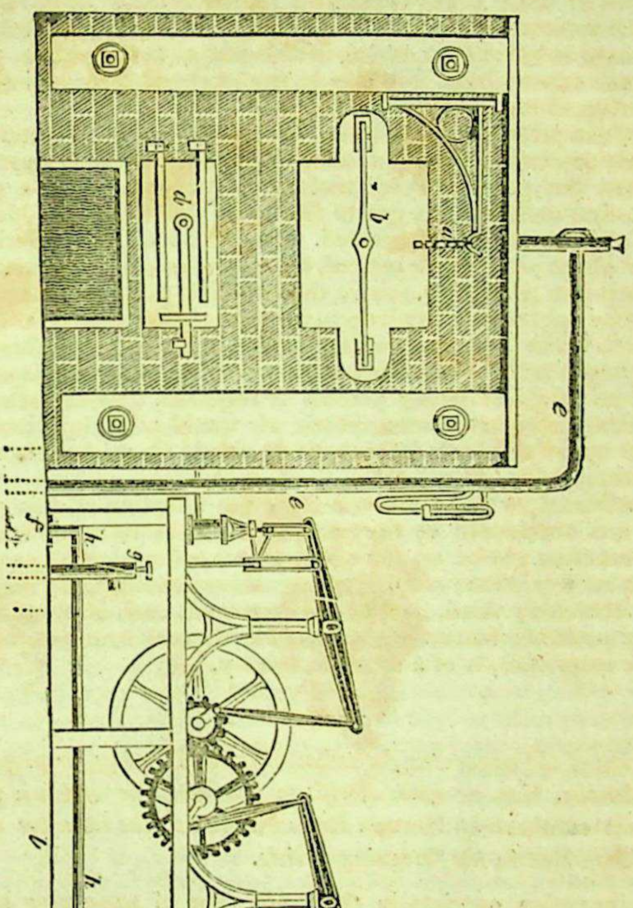
Account of the patent granted to SIMEON BROADMEADOW, *of Abergavenny, civil engineer, for a new method of preparing and purifying Inflammable Gases, by the admixture of Atmospheric Air.*

THE improvement proposed by Mr. Broadmeadow, consists, in the first place, in substituting brick ovens for iron retorts; secondly, in exhausting the gas from the ovens as fast as it is generated, by the application of an exhausting cylinder, constructed somewhat similar to the blast cylinder used in iron works, or by any other means of exhaustion; and, thirdly, in purifying the gas so generated, either wholly or partially, by admitting into the gasometer a certain portion of atmospheric air.

a is an oven, the size and number of these need not be restricted; *b*, the oven door; *d*, door of the fire-grate; *e*, a pipe, through which the gas is conveyed from the oven to the condenser, *f*, into which a small hand pump, *g*, is inserted, to draw off the coal-tar; *h*, a pipe, through which the gas passes from the condenser into the top of the exhausting cylinder *i*. The piston of this exhausting cylinder receives its motion from a small steam engine, or other mechanical power. The engine is supplied with steam from a boiler fixed in the flue, and heated by the waste fire of the furnace. *k k*, two pipes; one leading from the top, the other from the bottom of the exhausting cylinder, to the purifier *l*; *m*, an outlet pipe, to convey the gas from the purifier, into the gasometer; and *n*, is a pipe branching from the pipe *h*, to convey the gas, at each alternate vibration of the beam, into the lower part of the same cylinder.

As the term *steam engine* is apt to convey to the mind an idea of expensive apparatus, it may not be amiss to state, that the engine required for this purpose is so small, that were not steam the first mover, it would, speaking of it comparatively, even with an engine of one-horse power, be ill-deserving of the appellation.

In the erection of works, on the ordinary plan, one of the principal items of charge, is that for iron retorts, together with the hydraulic main, and other necessary connexions; and in conducting works thus constructed, an enormous expense is annually incurred, from the oxidizing or burning away of the retorts. Indeed, the oxidation of the retorts is so rapid, that, however the time of their duration may vary, from a difference in the quality of iron, or mode of constructing the furnace, they cannot withstand, on an average, more than eight or nine months' exposure to the fire.



BROADMEADOW's *Apparatus for preparing and purifying Inflammable Gas.*

In the patent process no retorts are used, but ovens constructed of brick, or other suitable materials; the cost of first erection, and the subsequent annual charge for wear and tear, is greatly diminished. The ovens are also subject to wear, and to require repairing; but the expenses thus incurred, are, comparatively speaking, too trivial to deserve mention. At works erected on this principle at Abergavenny, an oven, which has for the last two years been in constant use, is apparently uninjured; a less sum than twenty shillings each, per annum, is found sufficient to keep them in repair.

As each of these ovens contains a charge equal to about six full-sized iron retorts, and requires to be charged but once in twenty-four hours, there is not only a saving in the cost of first erection, and in the annual expenditure, but also in the labour usually expended in the drawing of the charges, and in re-charging.

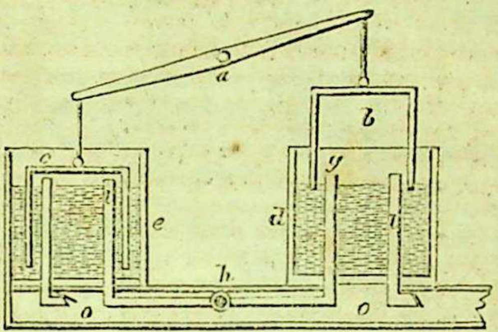
One of the principal features in Mr. Broadmeadow's invention, is, that of his application of an exhausting cylinder, or other apparatus, to exhaust the gas from the condenser, thereby causing a partial vacuum, and enabling the gas to flow from the ovens into the condenser, as fast as it is generated. A portion of atmospheric air, equal to about one-eighth part of the entire quantity of gas, is admitted into the gasometer, where the oxygen of the atmosphere, mixing with the sulphuretted hydrogen, precipitates the sulphur, and gives to the gas, when lighted, a greater degree of brilliancy. This mode of purifying is said to be so efficient, that when the coal used is of good quality, no other purifying process is required. As the admission of too great a portion of atmospheric air would prove injurious, the requisite speed at which the exhauster should be worked, is shown by a water-guage.

The advantages to be derived from the adoption of this patent process are considered by the patentee to be as follow:—first, the cost of erecting works on this principle, is calculated at one-third less than on any other; second, the annual expenditure for retorts is entirely obviated; third, the gas is improved, and much more effectually purified; fourth, the coke, from the coal being carbonized in larger quantities, is of a superior quality.

Description of the apparatus for exhausting, condensing, or propelling Air, Smoke, Gas, or other Aeriform products, for which a patent has been obtained by SIMEON BROADMEADOW, *the inventor of the ovens described in the foregoing article.*

THIS invention consists in the application of some very simple machinery for the purpose of exhausting or withdrawing air, smoke, gas, and other aeriform products, generated in the process of distillation, and by thus removing the pressure, producing a draught or current of atmospheric air through the fire-place, for the combustion of the fuel, and from thence up the chimney; also, in afterwards propelling the aeriform fluids withdrawn, so as to blow the fire of the furnace, or in otherwise disposing of it through flues or channels, as may be found desirable.

There are three forms of apparatus described in the specification, but the patentee states that he does not confine his claim to these particular arrangements, but includes every mode of applying the principle of exhaustion caused by raising a vessel inverted in water or other suitable liquid.* The first of these three forms is shown in the annexed diagram.



In the above figure, (which is a vertical section) *a* is the fulcrum of a lever or beam, with two inverted vessels, *b* and *c*, suspended to its extremities; these vessels are open underneath, but air-tight above: *d* and *e* are two larger vessels, filled with water to the same level, into which *b* and *c* respectively ascend and descend: *g h i* is a tube, or pipe, which passes through the vessels *d* and *e*, and reaches above the surface of the water; at the extremities are two valves, which respectively open outwards into the inverted vessels, with a pipe at *h* connected to the flue or furnace, where the exhaustion is to be effected. *k* and *l* are separate pipes, passing through the bottom of *d* and *e*, and extending a little above the surface of the water: they are open at top, and have valves at the bottom, opening into the trunk *o o*, for carrying off the gas, or smoke.

An alternating motion being imparted to the beam, by a steam engine, or other first mover, the air, smoke, or gas, passes up the tubes *g h i*, and fills each inverted vessel, as *b* and *c* are successively drawn up out of the water; the descent of the inverted vessels closes the valves at *g* and *i*, and opens those at the bottom of the tubes *k* and *l*, through which the gas or smoke is driven forward into the trunk *o o*, and thus, by the reciprocation of the beam, a continual blast, or stream of gas is produced in the trunk *o o*, to be applied as circumstances may require.

The subjoined figure represents another arrangement of the apparatus for situations where a motive engine cannot be applied, and where it is desired that the operation may be conducted slowly and regularly.

In this case, the inverted vessel is suspended by a chain, or rope, passing over a pulley, with a weight at the other extremity, sufficient to raise the inverted vessel, and thus perform the operation of exhaustion. *a* is the inverted vessel, *b* the tank, filled with water, as shown: *d* is the outlet pipe, having a valve opening outwards at the bottom. *e* is the inlet pipe, having a valve opening at top into the inverted vessel. When the inverted vessel is full of air, gas, or other elastic fluid, the weight *f* must be diminished, when the vessel, by its own weight, will propel the air contained therein, through the tube *d*, and, opening the valve at bottom, it will be driven forward in a current, to the point desired.

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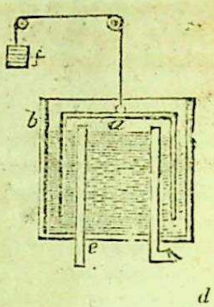
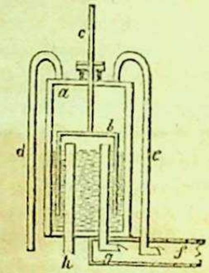
* In claiming so much, we think the patentee has been badly advised, as blowing machines and pumps have long since been made on similar principles. [*Editor of the Register of the Arts.*



The annexed figure shows the third mode described by the patentee. *a* is an air-tight vessel, closed on all sides, containing water to the height shown: the inverted vessel *b* is connected to a vertical rod *c*, which works through a stuffing box: *d* is an inlet pipe, with a valve opening into or towards the vessel *a*: *e* is an outlet pipe, with a valve opening into the interior of the trunk *f*: *g* is the outlet pipe to the inverted vessel, and *h* the inlet pipe to the same, each having a valve as shown, and described in the previous arrangements. By this contrivance it will be seen that, by the alternating action of the rod *c*, a partial vacuum will be effected, both in the inside of the inverted vessel, and in the upper part of the closed vessel, causing thereby a continuous exhaustion in the pipes or tubes connected thereto, and a subsequent propulsion of the air or gas extracted, into the trunk *f*, by which it is conducted to its destination.

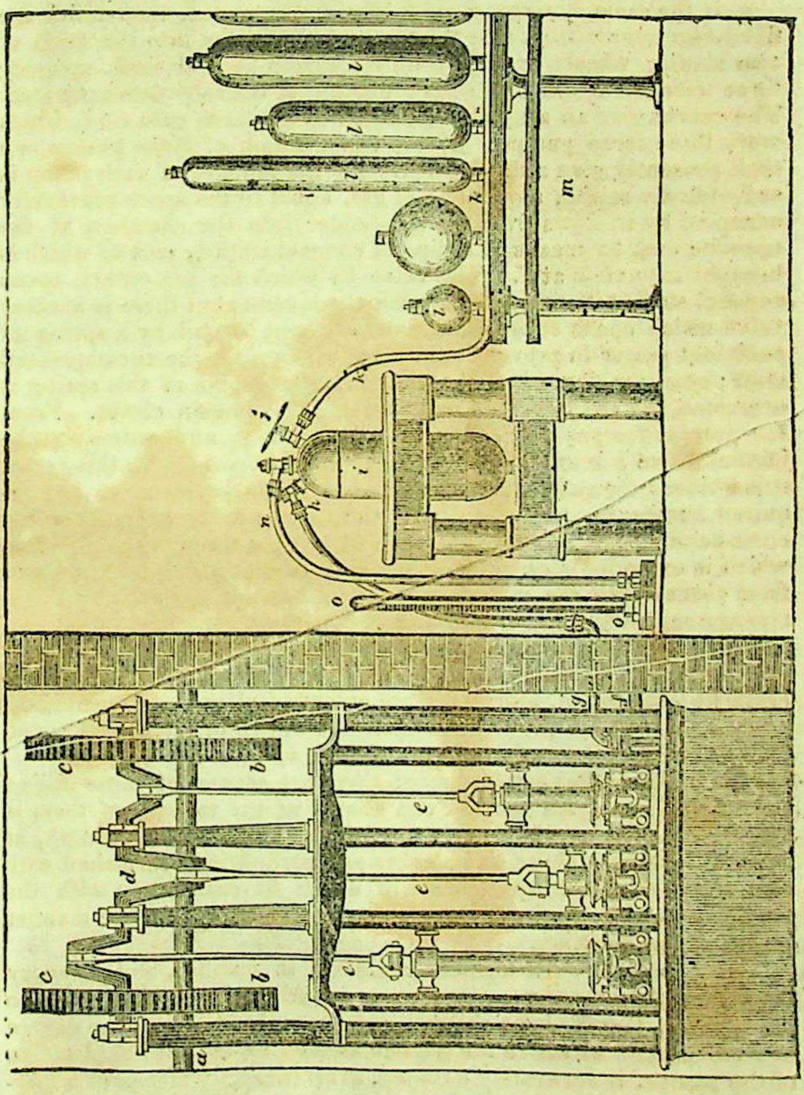


Description of the apparatus employed at the Portable Gas Works in London, for compressing the gas into portable lamps.

After the introduction of gas-lights, the idea of condensing it in strong vessels so as to render it portable, must soon have occurred to those habituated to think upon such subjects; the Editor, therefore, claims but little merit from having been, as he believes, the first to propose it. This fact may probably be recollected by Dr. Cooper, of Columbia College, South Carolina, who published a work on the subject of the manufacture and use of illuminating gas. The proposition was made to that gentleman, two or three years before any mention of it was made in the English journals.

According to the most recent intelligence, the objections which were, for a time, made to the employment of the condensed gas, have been either obviated by improvements in the apparatus, or have proved to be groundless, and the business of the company who carry on the works, is said to be greatly extending.

The drawing and description of the apparatus now used for the condensation, are furnished by L. Hebert, Esq. Engineer, who is the Editor of the "Register of the Arts," &c.; he has, in the drawing, brought some parts nearer together than they are in the works, in order to show the principal operations, at one view.



In the *Portable* Gas-works, as in all others, the gas as it is generated and purified, is conducted to, and kept in, those large vessels called gasometers, or rather gas-holders; so far the operations in gas-works do not materially differ, but here the similarity ends; for the gas, instead of being distributed from thence, through pipes, in its natural volume, under simple atmospheric pressure, is conducted from the gas-holder to the chambers of a set of force pumps, by which it is gradually compressed into a thirtieth part of its previous bulk. The manner of effecting this we will now explain.

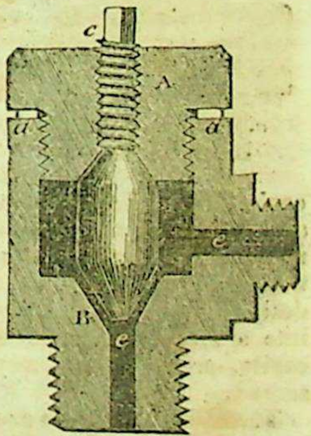
a, is the main horizontal shaft of a steam engine, upon which are fixed two spur wheels *b b*; the teeth of these take into the teeth of two similar wheels, *c c*, fixed on the axis of another shaft, carrying three cranks, to which a rotary motion is thereby communicated. The cranks give an alternating motion to the three rods *e e e*, which work three force pumps. Of the construction of these pumps, we shall presently give a description. As the plunger of each pump is successively raised, a quantity of gas, equal to the space previously occupied by it, flows from the gas-holder into the chamber, at the opposite end, by means of a pipe of communication, part of which is brought into view at *f*. The valve by which the gas enters, opens *inward*, so that it cannot return the way it came; but there is another valve which opens *outward*, and this is kept closed by a spring of sufficient power to prevent the escape of the gas in the uncompressed state; upon the descent of the plunger, the strength of this spring is overcome, the gas is forced out, and the valve again closes. From the pumps, the gas proceeds along the tube *g*, and enters by the jointed valve *h* into a strong wrought-iron recipient, *i*; in this vessel it is evident the gas might be collected and condensed to any required number of atmospheres; but the valve *j* being opened (by the cross-handled key shown) it is suffered to flow through the pipe *k k*, which is extended along the upper side of the filling table *m*, and from thence into the reservoirs (portable lamps,) *l l l l l*; by which arrangement the pressure of the gas becomes equalized in all the vessels, however great their number. In this manner thirty or forty lamps are filled at a time; but as the limits of our diagram are necessarily contracted, and as a more extended view would be useless, only five lamps are shown; and these are drawn of various sizes and shapes, to show the various forms of these vessels.

In a Portable Gas establishment there are several of these *filling tables*, similar to the part of one shown at *m*; to each of them is fixed a conducting tube like that at *k k*, running the whole length; at regular distances along these tubes are perforations furnished with strong well-screwed nozzles, all of which fit easily, yet with the utmost precision, to the bottom valve of the lamps, in the manner shown in the drawing.

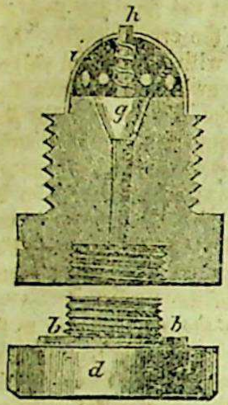
The pumps at work together, were six in number, and as every descent of the plungers compresses a quantity of gas uniformly into every lamp, they become gradually, yet rapidly, filled. The degree of condensation at which the gas has arrived by the continual action of the pumps, is accurately denoted, at all times, by means of a mercurial gauge, applied in the following manner. The pipe *n*, which proceeds from the recipient *i*, conveys the gas under compression into the reservoir of mercury at the bottom of the gauge *o o*; the pressure of the gas upon the surface of the mercury, causes the latter to rise in a long glass tube, which has an accurately graduated scale affixed to it, showing clearly the degree of pressure, or condensation, in the lamps. When the mercury arrives at the line denoting 30 atmospheres, the valve *j* is shut by means of the cross handle. All the lamps attached to the pipe in connexion with the closed valve, being now filled, are taken away, by unscrewing them from the sockets in the tube. The lower valves of the lamps close by the pressure of the gas within them, and the contents are further secured from escaping, by screwing a cap over these lower valves. To ascertain whether there is any leakage, the lamps are now taken by another workman, and immersed in a trough of water, where, if any exists, it is immediately shown by the bubbling up of the gas. The lamps are taken out to their destination by the company's carts, which are regularly despatched to all parts of the town.

The tube *g*, which conducts the gas from the pump-house to the recipient, *i*, is immersed in water by passing through a trough filled with that fluid, by which, if any leakage should take place in this supply pipe, it may be immediately detected. Instead of only one mercurial gauge, there are usually three employed together; each of these have a communication with the vessel *i*, so that if the action of one of them should prove defective, it is immediately discovered by its disagreement with the others.

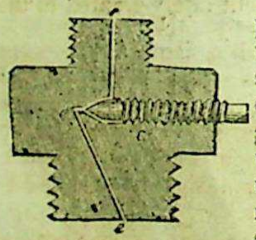
It now becomes necessary to describe the *construction* of the valves. They are of three distinct kinds, having each their peculiar and separate uses, and were the subject of a patent lately granted to the inventor, Mr. David Gordon.



The annexed engraving gives a sectional view of an improved stop valve, similar to those shown in the condensing apparatus, attached to the principal recipient, *i;* this is especially adapted for transferring the compressed gas from one vessel to another, without occasioning loss during the process. It is composed of two pieces of metal, A and B, which are screwed together with a soft metal collar between them, at *a a; e e* represent the openings through which the gas is allowed to pass. The piece A has the regulating steel screw *c* tapped through it, being formed at the lower part with a double cone, one part of which cone is adapted to fit correctly into the cavity in the under side of the piece A. Now when the lower cone of the regulating steel screw is screwed or forced tight down into the conical seat in the piece B, it prevents all escape of the gas; and when it is desired to transfer compressed gas from one lamp, or reservoir, to another, the regulating screw *c*, is to be turned until its upper cone fits and applies correctly into the conical cavity in the piece A, and thereby prevents all escape of the gas up the threads of the regulating screw during the process of transferring, allowing at the same time free passage of the gas from one reservoir to another through the openings *e e*.



This figure is a sectional representation of the improved valve, which is fixed at the bottom of each reservoir or lamp, for the purpose of filling them in the manner before described. This filling valve consists of a small conical plug, *g*, which is fitted into a conical cavity or seat in the piece of metal, *c*, similar to the valves of an air gun, being closed by a slight steel spring *h*, and guided in its way by a metal pin, which slides through a hole in a small brass cap or perforated cover, *i*, represented as screwed over it; *d* shows a brass plug, which is intended to be screwed into the lower aperture of the piece *c*, after the filling is completed. The upper surface of this screw plug, is furnished with a soft metal ring or collar, *b b* (as in the before mentioned valve,) which being pressed by the force of the screw into close contact with the under side of the piece *c*, effectually prevents any escape of the gas from that end of the reservoir, even if the filling valve, *g*, should not be quite air-tight.

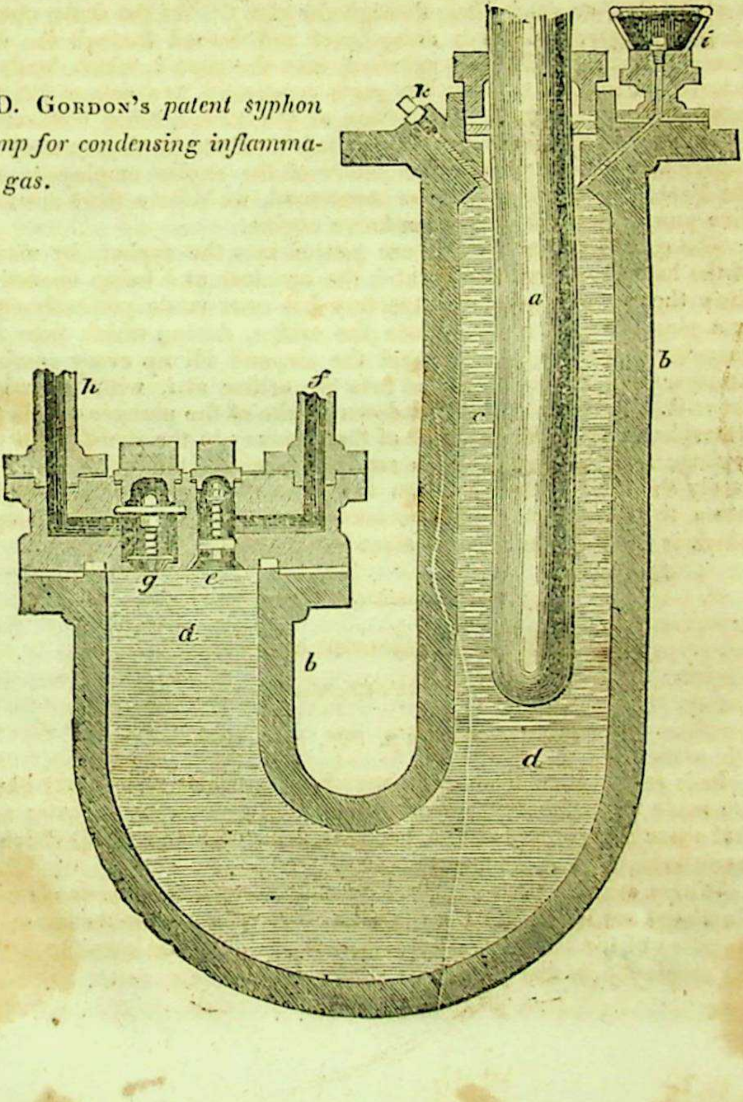


This figure exhibits a section of an improved valve for regulating the flow of the gas to the burner, with great nicety and precision. The passages for the gas *e e*, are drilled out of one solid piece of metal, and the regulating screw, *c*, is tapped into the side of the same piece; the lower part of it is adapted to screw into an aperture at one end of the reservoir of the lamp; when the regulating steel screw, *c*, is screwed up, so that its conical end fits tightly into the conical cavity, it closes it perfectly, and prevents all escape of gas to the burner; but on turning the regulating screw slightly round by its square head, the gas escapes through the passages *e e*, to the burner, in any degree that may be desired. Previously to inserting the regulating screw, it is dipped into a mixture of bees wax and oil, which fills up every minute cavity, or space, that may be left between the threads of the two screws.

The soft metal rings or collars (before mentioned) are firmly fixed by soldering, or otherwise, to one of the surfaces which form the joint; they are not therefore in danger of being displaced or injured by screwing them up hard, but produce a very tight and sound joint.

Description of the patent quicksilver syphon pump for condensing gas; as it is constructed and used at the portable gas-works, London.

This syphon pump was invented about four years ago, it has, ever since, been in use at the portable gas-works, in Sutton street, London, and has been found to answer the purpose intended perfectly well. The intervention of the water, and the quicksilver, between the plunger and the chamber which is to contain the gas, we think a peculiarly happy idea, as it obviates entirely the danger of the waste of gas, or the admixture of atmospheric air, from defective packing. The annexed cut will give a complete view of the whole construction of the essential parts of the instrument.



D. Gordon's *patent syphon pump for condensing inflammable gas.*

The figure *b b*, represents a vertical section of one of the pumps with the plunger *a*, at the lowest point of its descent; at this moment, every part of the syphon is completely filled with the two liquids which it contains, to the entire exclusion of air; the part *c*, shadowed with broken lines, being water, and the part *d d*, quicksilver. It will, therefore, be easily conceived that when the plunger is drawn up, an empty space or vacuum equal to the volume of the plunger will be left in the syphon; and as mercury is a much heavier body than water, the latter will be pushed up by the former, and follow the plunger as it ascends. The mercury consequently sinks below its present level, which causes the *suction valve*, *e*, to open, and to let in a volume of gas of ordinary density, which flows from a gasometer, or gas holder, through the pipe *f*. At the down stroke of the plunger, the gas is compressed and forced through the discharge valve, which opens outward, into the pipe *h*, which leads to a strong recipient, wherein the gas is condensed, as shown at *i* in the condensing apparatus. The action of the pumps being continued, the compression of the gas is effected to whatever degree may be required, not transcending the power of the engine employed. In the Portable Gas Works above mentioned, we believe there are now nine pumps at work with a ten horse engine.

The quicksilver and water are poured into the syphon, by means of the basin, and perforation at *i*, the aperture at *k* being opened to allow the air to escape; the aperture *k* is next made perfectly tight by a plug which is screwed into the orifice, during which time the water is poured in at *i* to expel the air, and fill up every crevice. Another plug is then screwed into the orifice at *i*, with the water above it. After this, the first down stroke of the plunger expels the atmospheric air on the surface of the mercury in the short leg of the syphon; and the pump is then ready to perform the office of alternately drawing in the gas from the gas holder, and compressing it into a thirtieth part of its previous volume in the portable lamps; which is done in the manner already described.

Essay on Earthenware and Porcelain.

[From Parke's Chemical Essays.]

Continued from p. 307, and concluded.

It is said that in France the very best crucibles which they have, are made with fine clay mixed up with old ground butter pots; and that these are composed of a peculiar kind of stone ware, which is manufactured in Normandy.

Where crucibles are required for melting metals, those made with plumbago are decidedly the best; but these are unsuitable for other purposes of the laboratory, especially when salts and alkaline fluxes are employed in any process.

In a paper by Vandermonge, Monge, and Berthollet, on the manufacture of steel, and which was published by order of the Committee of Public Safety in Paris, in the second year of the republic, they say, "One of the greatest difficulties we find in this country (France) is to procure good crucibles." The art of pottery in a manufacturing country like Great Britain, is, in all its parts, truly important.

More than eighty years ago the celebrated Reaumur, in making some trials on glass, discovered, that if a vessel made of the common green bottle-glass be submitted to the heat of a potter's oven, imbedded in a mixture of sand and ground *sulphate of lime*, the glass of which it is composed will be changed in its appearance, and acquire some of the properties of the best Oriental china; become so hard as to strike fire with steel; be semi-transparent like porcelain, and will endure sudden changes of temperature without breaking. An account of these results was given in the Memoirs of the Royal Academy of Sciences for the year 1739.

Having mentioned this, I have only room to add, that the late Dr. Lewis, who conceived highly of this discovery, made many experiments to ascertain its nature and importance, the particulars of which, together with several most judicious remarks upon them, will be found in his celebrated work on the commerce of the arts.

The subject, however, appears to me to be highly deserving of still further investigation, especially as useful vessels of a difficult form may be made more easily of glass than of earthenware. If, therefore, a cheap and certain method of performing this species of cementation could be adopted, the operative chemist would have it in his power to procure a greater variety of chemical vessels, and those not only more durable, but of more convenient forms than he can possibly obtain by any other means. I wish some potter would commence a manufactory of this kind. Such ware would be highly useful for many domestic purposes, to which none of the common pottery can be applied either with convenience or safety.

In returning to the subject of earthenware, it is proper I should state my opinion, that chemical vessels are often injured by the oxide of iron originally pertaining to the clay itself, as it acts like a flux, rendering this earth too fusible to admit of a proper union with the siliceous material of the ground pottery, which is employed in the manufacture of such articles. A question arises here, whether *oxide* of iron alone is prejudicial in this way, although its sulphuret, the pyrites, may be. It may, perhaps, be worth while to decide this by experiment. Macquer says, that if a bit of pyrites be left in clay which is to be exposed to a baking fire, it will form a cavity in the ware, and that this may be known by the circumstance of the cavity being stained black.

There is, in the London Institution, an old pamphlet of nine pages without title-page or date, on making porcelain, in which the writer speaks of a practice the Chinese have, of purifying the earth they employ for the glaze, by means of aqua-fortis. On reading this, it occurred to me, that it might perhaps be worth trying, whether this expedient could be adopted with advantage in purifying such of our clays as are designed for the finest purposes.

For those articles in which the chemical nature of the body of the ware is of importance, it would, perhaps, be adviseable, always to wash the clay thoroughly; for, if pyrites be contained in it, the greater part of this would subside, on account of its superior specific gravity, while the argillaceous earth remained suspended by the water. For chemical jars, still heads, &c. a *small* portion of iron would probably not be injurious. Vauquelin analyzed the clay of which Hessian crucibles are made, and found it to consist of eight parts oxide of iron, combined with 69 of silica, 22 alumina, and one carbon.

Clay which contains lime is equally improper for the manufacture of chemical vessels. If a clay be suspected to contain lime, or rather carbonate of lime, it may readily be discovered by an acid, which, if this earth be present, will occasion an effervescence. When lime does not exceed five or six per cent., it appears to do no harm to the quality of the pottery; but when more abundant, it communicates too great a degree of fusibility: in like manner, there are cases in which an admixture of the oxide of iron is useful, and even necessary.

In the manufacture of what is called Delf-ware, it has been customary to mix a portion of ferruginous clay with the other ingredients, because of its possessing a binding quality, from which other species are exempt. The following are the usual proportions: two parts of red clay, three of blue clay, and five of marle. Most of the red clay is indebted to iron for the colour which it assumes; but when iron enters in any considerable quantity into the composition of the finer kinds of earthenware, it imparts either a red or a brown tinge to it; and besides this, it adds more fusibility to it than even lime.

Recollecting the circumstance just mentioned respecting Delf-ware, it occurred to me, in reading one of the volumes of the *Archæologia*, that a certain iron-ore found in Scotland would probably be useful, when mixed in a small proportion, for some articles of pottery. I will give an abstract of the passage which caught my attention; and if any ingenious manufacturer should be able to avail himself of this hint, and convert it to profit, I shall be rejoiced, and shall at any time be glad to be informed of the result, and the respective particulars which attended it.

In the Highlands of Scotland, some very singular ancient walls are to be seen, which consist of "stones piled rudely upon one another, and firmly cemented together by a matter which has been vitrified by means of fire, and which forms a kind of artificial rock that resists the vicissitude of the weather, better than any artificial cement that has ever yet been discovered."

Mr. James Anderson, the person who has written upon these curious remains of antiquity, has found that through all the northern parts of Scotland, a peculiar kind of iron-ore of a very vitrescible nature, is found in great abundance. Hence he supposes that "when the walls were reared and made as firm as could be by dry stones piled one upon another, the interstices between them were filled with this vitrescible iron-ore, and the whole supported by a backing of loose stones piled behind it. When this wall was thus far completed, nothing more was necessary to give it the entire finishing, but to kindle a fire all round it, sufficiently intense to melt the vitrescible ore, and thus to cement the whole into one coherent mass."

Dr. Lewis has related a remarkable instance of the affinity of iron for silica. Having immersed some pieces of green glass in the red oxide of iron, which remains after the acid has been expelled from green copperas, and baked it for several hours in the upper chamber of a wind furnace, the glass and oxide of iron were found to have run together into a black mass, of sufficient hardness to strike fire freely with steel. "It is remarkable," says he, "that a metallic substance, so refractory in the fire, should be so greatly disposed to melt with green glass."

Nothing can be of more importance to a potter than a thorough knowledge of the properties of the different kinds of clays. Dr. Campbell, in his Political Survey of Great Britain, states that we have not less than twenty-two distinct species; and Macquer, who examined more than eight hundred specimens, says that in all that number he did not find one that was entirely free from metallic matter.

There is only one method, however, by which clays can be examined with any accuracy, and that is by the aid of chemistry. Such of my readers who are potters but not chemists, will, therefore, allow me to advise them to lose no time, in acquiring the knowledge of analyzing earths and minerals. Ample directions for the attainment of this art will be found in Kirwan's Elements of Mineralogy, or in Klaproth's Analytical Essays; and I conceive it impossible that any manufacturer will ever regret the time which it may be necessary for him to devote to the acquisition of that elementary knowledge, which would enable him to consult these distinguished writers with pleasure and advantage.

One or two instances of the mistakes which may occur in the examination of mineral substances, when they are not submitted to chemical analysis, will be sufficient to show the importance of this inquiry, and will, I hope, induce the junior practitioners, at least, to adopt this advice, and enter upon that course of study which will be most likely to afford profit as well as entertainment.

The precious stones were formerly classed with siliceous fossils; and until Bergman and Klaproth analyzed several of them, they were generally supposed to be entirely composed of silica, combined with a portion of colouring matter, to which they were solely indebted for their distinctive characters and appearances. An accurate analysis of several of these gems, particularly of the sapphire, the topaz, the hyacinth, and the ruby, has, however, proved that either alumina, or zircone, and not silica, is in these instances the predominant ingredient. The sapphire, according to Klaproth, consists of clay 98.50, oxide of iron 1, lime 0.50. The topaz consists of clay

46, silica 39; lime 8; iron 6. The hyacinth of zircone 70, silica 25, oxide of iron 0.50, loss 4.50. The ruby is composed of clay 40, silica 59, lime 9, and iron 10.

The well-known article called fuller's earth, from its saponaceous texture, had been supposed to consist almost entirely of clay or alumina; but on an accurate analysis, it has been ascertained, that the earth which enters into its composition in largest proportion, is silica. According to the analysis of Bergman, fuller's earth consists of silica 51.8, alumina 25, lime 3.3, magnesia 0.7, iron 0.7, water 15.5. Hence it may be accounted for, why it falls into a powder when put into water, and is incapable of forming a ductile paste. On the contrary, emery, which has very much the appearance of sand or ground silica, is for the most part argillaceous earth or alumina, and the siliceous earth is in a very inconsiderable quantity.

The last instance which I shall adduce, is one that is intimately connected with our subject, and which shows decisively how necessary it is for a potter to be capable of undertaking a chemical analysis.

The porcelain earth of Baudiffero was pronounced by Macquer and Baumé to be a CLAY, superior in quality to that which was then employed in the manufactory belonging to the French king at Sevres; and on their authority this was generally believed, till Mr. Giobert discovered that not a particle of clay could be found in it. For, when this chemist attempted to convert it into alum, he found, to his great surprise, nothing but very pure crystals of Epsom salt, or sulphate of magnesia. After this, Giobert analyzed this mineral with great care, and found it to consist of magnesia 68, carbonic acid 12, silica 15.6, sulphate of lime 1.6, and water 3.

Since that period, magnesian earth has been much employed in the composition of porcelain, it having been ascertained that a small portion of it prevents that great degree of contraction, which always takes place in the fire, when clay and silica alone are made use of. The Cornish steatites, or soap rock, being a mineral containing magnesia, some of the English potters now employ it for this purpose.

I have understood, that in England, the steatites was first used by the porcelain manufacturers at Worcester, and that they paid at the rate of £20. per ton for it. In a well-known publication it has been stated, that much of the land is in possession of the great Staffordshire houses, who have taken leases of it, for the purpose of possessing themselves of this very valuable natural production. I learnt, however, in the year 1815, from most respectable authority, that *steatites* had then never been employed by the Staffordshire potters.

The steatites of Cornwall occurs at the Lizard point, in a serpentine mountain which it cuts through in small perpendicular veins, called *rake-veins*. The finest sort is white, with blueish or reddish spots, resembling marble. The best analysis of this mineral gives silica 48, magnesia 20.50, alumina 14, oxide of iron 1, water 15.50, loss 1.

It might, perhaps, be worth while, for the glass-makers to try the effect of a small mixture of *steatites*, with the materials of which they make their large crucibles; because, if it prevent that great degree of shrinking to which they are now liable, it would be very advantageous.

I have been informed by an eminent maker of plate glass, that their crucibles, which are at first 32 inches deep, will not measure more than 29 inches when they have undergone the heat of the oven and become thoroughly baked; and that this contraction has occasioned very great loss, especially in respect to the excise duty.

These glass-house pots are very large vessels, being made to measure nearly as much in diameter at the top, as in depth, consequently the shrinking, on the whole, is very great; and as the officer of excise gauges them before they are burnt, the manufacturer incurs a loss of duty upon as much glass as might be contained in the depth of three inches, and this loss recurs every time such crucible is charged; so that a manufacturer who pays £5000 per annum in duty, must pay £500 every year more than was contemplated by the legislature.

I am very glad, however, to have it in my power to inform my readers, that since this was written for the first edition of this work, the hardship there complained of is entirely removed, the government having made an alteration in the mode of collecting the duty on glass; for, instead of gauging the crucibles, the duty is now charged on the finished glass itself according to its actual weight.

Having ventured to offer these observations, I shall conclude with a few hints, which to practical men, may perhaps be useful.

There is a clay found in the territory of Sienna, in the province of Tuscany, called *fossil meal*, and by Kirwan, Argillomurite, which is capable of making hard compact bricks that will float in water, either baked or unbaked. M. Fabroni, who examined some of these bricks, in consequence of their having been mentioned by Pliny, says that they may be of great use in the construction of reverberatory furnaces; for they are such bad conductors of heat, that although one of such bricks should be made completely red hot, from one end to its middle, any person may take it up in his hand by the other end with impunity. May it not then be worth while to inquire, whether a clay possessed of similar properties cannot be found in Great Britain?

Moreover, considering the improvements which have been made in the manufactory of pottery, might it not be easy to make bricks to imitate stone, and yet be as durable as the bricks now in use?

By means of the metallic oxides, would it not be possible at a cheap rate to stain bricks of any colour, and might not such bricks be made to imitate marble?

In the Essay on Barytes, I have stated, that Mr. Wedgwood employed the sulphate of that earth in the manufacture of jasper; but if pure barytes itself, or strontites, could be procured without much expense, might not these also be used with advantage in some of the branches of pottery? A method of employing sulphate of barytes in pottery is indeed alluded to by Sage, in one of the volumes of the *Journal de Physique*. "The Chinese," says he, "know the remarkable property which gum adracanth has of giving a coherence to minute stony substances; which are then unalterable by fire; and that if this gum be mixed with pounded sulphate of barytes, it may be formed into masses, which neither alter their shape nor solidity from exposure to an intense fire. I have not heard that any English potter has yet availed himself of this suggestion.

The sulphates of barytes and strontites may be had cheap, and in abundance; and all that would be necessary, is to roast them in a reverberatory furnace with some combustible matter, to convert them into sulphurets, and then the remaining sulphur, should it prove injurious, could be separated by a subsequent process. In this way an ingenious manufacturer might probably gain unexpected profits and improvements from one or both of these earths.

In concluding this essay, I trust I shall stand excused, if I endeavour to confirm an opinion already given, that a potter should never employ a new porcelain-clay without previous analysis; for there are few of these clays that can be employed with the certainty of a good result, unless some fusible material be used with them; and the quantity of this can only be known by a chemical examination of the clay in question. The necessity of analysis will appear from the comparison of the chemical nature of three of these native productions. The porcelain earth of Limoges, and which is often used without any admixture, is, according to Hassenfratz, composed of 62 parts silica, 19 alumina, 12 magnesia, and 7 sulphate of barytes; whereas, the porcelain-clay of Cornwall, is a compound of 20 per cent. of silica, and 60 per cent. of alumina; while that found in the department of the Loire in France, of a beautifully white colour, consists entirely of carbonate of magnesia and silica.

The business of a potter affords so large a field for the exercise of taste and genius, and the art itself is so intimately connected with chemical knowledge and experience, that it would be superfluous to urge by further arguments, the absolute necessity of cultivating the science of chemistry, in order to arrive at perfection in any branch of the manufacture.

Remarks on Rennie's *Essays on Bleaching.*

We now present the last essay of the series on the subject of bleaching. The author of them has collected and arranged a mass of historical and practical facts, which are valuable; he has, however, left much to be desired by the practical bleacher, which we hope hereafter to supply. We have been strongly inclined to omit the concluding part, which contains the writer's theoretical views, and have published it only for the purpose of making the series complete.

To practical men, theoretical discussions are, in general, unintelligible; and unless the writer be deeply versed in the subject, he, in entering upon them, ventures on dangerous ground, being more likely to display his own weakness, than to add to the stock of our information, or to improve the mode of our arrangement. We know nothing of Mr. Rennie, excepting through the medium of his essays, which have manifested a commendable portion of industry, but his theoretical views appear to us to be, sometimes, not merely gratuitous but absurd; he however, it seems, is young, and this should be deemed a sufficient apology for that fondness for theory, which time and experience will undoubtedly chasten and regulate. [*Editor.*

ESSAYS ON BLEACHING.

By James Rennie, *A. M. Lecturer on Philosophy, &c. London.*

HINTS RESPECTING THE THEORY OF BLEACHING.

[Conclusion of the series.]

When I entered upon my inquiries into the art of bleaching, I anticipated that I should find the theoretical discussions connected with it, very instructive, and opening a wide field for philosophical research. In the first of these anticipations I have been greatly disappointed; the second has much embarrassed me; for the field of research is so extensive, and withal so impenetrable by the ordinary paths of philosophy, that I have been discouraged from attempting what Newton and Herschel, and Berthollet and Davy, have failed to accomplish. When it is recollected that it embraces the very difficult subject of colour and coloured light, as well as the most abstruse doctrines of chemistry, this will appear no way surprising. I shall, therefore, be obliged to relinquish the thought of giving a connected theory of the art, and must content myself with the few imperfect hints which have come to my knowledge. I have even left myself but little room for these, as the essay has already swelled beyond the bounds which I had prescribed to myself at its commencement. The imperfection of the theory, however, is of little moment in the practice of the art, and if the chemical bleacher can explain the proximate operations of affinity in destroying colour, he need give himself very little trouble about the ultimate causes of coloured light and its decomposition.

Newton, having been able, by means of a glass prism, to decompose a ray of white light into seven different colours, came to the conclusion, that light is made up of those colours proportionably blended, and that bodies derive their colours from their capability of absorbing or reflecting rays which are differently coloured. A cowslip, for example, reflects the yellow rays of the compound light, and absorbs all the others. It strikes me that some very curious consequences may be deduced from this theory. It evidently proceeds upon the supposition that light is material, and can be mechanically divided, which is assuming what will not be granted without proof; but allowing the assumption, how comes it that the flower leaves of the cowslip do not increase in bulk from the absorption of a continued stream of light? And ought not this effect to be very apparent in the dark petals of the night-shade, which, by the hypothesis, reflects almost none of the light that falls upon them? If it be said that plants have a particular set of organs which decompose this absorbed light, and convert it into nourishment, how will this apply to inorganic matter, coloured wafers for example, and coloured paper, which are not found to increase from this supposed absorption of light? Besides, why, if the same kind of rays, in every circumstance, is precisely similar, should some be always reflected, and others transmitted? This seems, on this hypothesis, wholly inexplicable. Later philosophers, among whom is M. Prieur, reduce the number of primitive colours to three, namely, red, green, and violet; the intermixture of red and green giving rise to orange or yellow, according as the one or other predominates in the composition, and so of the other. It is certain that by a particular mode of management, he produced white light by an intermixture of red, green, and blue rays. Delaval, in an experimental inquiry into the cause of the changes of colour, which is more laboured than philosophical, goes deeper, as he thinks, into the subject than Newton, and tells us that the result of his experiment was, that transmitted light is the cause of colour,—for all bodies being, as he says, naturally white, it is only by means of a thin transparent pellicle which covers them, and transmits the light, that they appear of different colours; according as the pellicle is thick or thin. Scrape, says he, a dyed feather, and you will find it white below this pellicle. Again, when the colouring matter of plants is extracted from them, the solid fibrous parts, thus divested of their covering, display that whiteness which is their peculiar characteristic. White paper and linen are formed of such fibrous vegetable matter, which is bleached by dissolving and detaching the heterogeneous coloured particles. It also appears, he thinks, that the earth which forms the solid substance of plants is white; that it is separable from the colouring matter by several means; that whenever it is either pure and unmixed, or diffused through transparent colourless media, it exhibits its whiteness, and is the only vegetable matter which is endued with a reflective power; that the colours of vegetables are produced by the light *reflected* from this white matter, and transmitted thence through the coloured coat, or covering, which is formed on its surface by the colouring particles, and that whenever the colouring matter is either discharged, or by solution divided into particles, too *minute to exhibit any colour*, the solid earthy substance is exposed, and shows its native whiteness. But this is assuredly a mere vision, and as unworthy of refutation as the mechanical theory of chemical combination and decomposition. Delaval's mode of experimenting was such as might prove any hypothesis, however absurd; for he seems not to have first made his experiments, and thence drawn conclusions, but to have laid down an hypothesis with which he was previously determined that his experiments should agree. This opinion acquires confirmation from the beautiful and luminous experiments of Dr. Herschel, by which he proves satisfactorily that colour does not at all depend upon the size of the particles of matter, nor on the thickness or thinness of pellicles. (*Phil. Mag.* xxx. 206.)

Another hypothesis is, that light is a fluid, and the effect of the prism is to produce a chemical rather than a mechanical decomposition; and if this were sufficiently developed, I think it is more than probable that it would afford the most rational theory which has yet been proposed.

It will here suit our purpose better, to consider light as composed of three different sorts of rays, calorific, colorific, and de-oxidizing. The latter of these seem to act chiefly in decomposing bodies subjected to their influence, and are denominated de-oxidizing from their power of disengaging oxygen from its combinations. When nitric acid, for example, which is destitute of colour, is exposed to the rays of the sun, oxygen gas is partially disengaged, and the acid becomes reddish. A similar effect is produced on the oxides of several of the metals, particularly the oxide of silver and gold, which are thus partially deprived of oxygen, and approach the metallic state. When paper, moistened with nitrate of silver, is thus exposed to the light, it immediately becomes black; and muriate of silver is similarly, and even more speedily affected. It appears, then, that light produces changes in colour more by the disengaging of oxygen than by any mechanical reflection or transmission of its rays or particles. It will follow that oxygen is a principle much concerned in the original production of colour. This is confirmed by several facts which I have been at some pains to collect. When too much oxide has been employed for purifying flint glass so as to occasion purple colour in the plates, it is usual to thrust a piece of wood into the mass of melted metal, which quickly abstracts the colour. The oxide seems to impart its colour to the glass only when it is in a high state of oxidizement: the wood therefore becoming carbonized, abstracts a part of the oxygen, and the *colour of the glass disappears.* (*Parke's Ess. on Glass*, Note v. 203.) That oxygen is the colouring principle seems probable also from this, that the woollen dyers cut their logwood into chips, sprinkling it abundantly with water, and in this moistened state, throw it into great heaps, where it lies till the chips become heated, or fermented. After lying a few months in this state, they give out their colouring matter in the dying copper much more easily, and in greater abundance. This may be accounted for, by supposing that the water becomes in part decomposed, and that the oxygen uniting with the colouring matter renders it more intense, similar to the case of fruits, which deepen in colour as they ripen, by their gradual absorption of oxygen, (*see Ann. de Chim.* vi. 80.) When salts become coloured by accident, the manufacturing chemist employs charcoal to purify and clear them. He dissolves the salts, boils the solution on charcoal, and when recrystalized, they are found to be pure and colourless. (*Parke's Ess. on Carbon*, ii. 311.) Now does not this, I would ask, arise from the property which charcoal has of absorbing all the known gases, and condensing them within its pores in quantities, far exceeding its own bulk? *See Journ. de Phys. An.* 12, where Morozzo proves this by a series of experiments. And does it not appear plain that the charcoal, in the case in question, absorbs the oxygen gas, and so effects the destruction of the colouring matter of the salts? The phenomena exhibited by sympathetic inks seem all to countenance this idea. That prepared with muriate of cobalt, for example, which appears and disappears according to the presence or absence of a certain quantity of caloric. When the muriate of cobalt is pure, it produces with caloric a beautiful blue; when mixed with iron, the blue becomes green. Now, in this case, does it not seem probable that the caloric facilitates the combination of the oxygen of the atmosphere with the metal? or is it the caloric itself which is the colouring principle? Thenard found that when a piece of purified phosphorus of a pale yellow colour was melted in *hot* water, and then plunged into *cold* water, it became perfectly black, and always recovered its original colour upon being re-melted. Biot confirmed this, and attempted to show that colour depends on the mechanical condition of the component particles of bodies. A fact analogous to that stated by Thenard, was observed by Dr. Brewster in preparing prisms of realgar by melting it between glass plates. This substance is naturally of a dark orange red, but it became darker as the heat was increased, till at a certain temperature it became quite black; when cold it recovered its original red colour. Mr. Brande states that when nitrous acid gas is exposed to heat, its orange colour becomes more intense, so as to appear nearly black. (*Journ. of Sc. and Art.* i. p. 200.) M. Hermstaedt concludes from a series of well conducted experiments on the colouring principles of cochineal, (*Phil. Mag.* xiv. 319.) that many of the metals and earths possess a certain chemical affinity for this principle, and that the *acid*, which serves as a solvent for these substances, exercises a great influence on the shades produced. Oxygen also he found to affect, considerably, the production of scarlet by the muriate of tin, when oxidated by the air. The same doctrine seems to be farther confirmed by the very interesting and curious experiments of sir Francis Ford, (*Phil. Mag.* i. 100.) who found when oxygen was diffused through water, and sprinkled on flowers, that they assumed more brilliant colours, and even, in some cases, had those colours considerably changed. It has also been thought by some of the ablest chemists of the age, that oxygen is the agent which affects the colour of the blood. Those facts might easily be multiplied almost to infinity. I shall, however, hold these to be sufficient. *See Bancroft*, p. 15.

But granting it proved that oxygen is one of the chief principles which produce colour, we are still totally in the dark, as to the manner in which it acts, in the case in question. Does it decompose the rays of light? or does it modify their action on the organs of vision? If it does so, why does it not always produce the same effect, or, in other words, the same colour? If light be a fluid composed of different particles, is it by atoms of oxygen combining with these in definite proportions that the phenomena of colours are produced? If so, how many atoms of oxygen, in combination, constitute, for example, a green colour?

During the course of the essay, I have frequently mentioned the colouring matter of the several stuffs; were I to be asked what I understand by this colouring matter, I would answer, I do not mean any definite chemical principle, such as oxygen, or tannin, but use it as a general expression for oils, resins, gums, or other chemical constituents which may be tinged with any colour. Several of our illustrious modern chemists have attempted to show that there exists, chiefly in vegetables, a proximate principle, distinct from every other constituent of plants, in which colour principally resides, and to which they give the name of colouring matter. The evidence which is adduced for the existence of such a principle, seems to me, to be extremely vague and doubtful, and there are facts which appear nearly conclusive against its existence. If there were such a principle, it ought, according to the analogy of some similar principles, to possess invariable characteristics by which it might always be recognized. Nothing like this, however, has yet been discovered. Certain vegetable colours, indeed, such as red and blue, are uniformly affected in the same manner, by acids and alkalies; but does this prove that the blue and red are similar properties of the *same* colouring principle? does it not rather prove that those two colours are widely dissimilar, and give reason to infer, that the principle upon which they depend, is also very different in some of its properties? Mr. Murray tells us that many vegetable products, possessed of deep, or of vivid colours, agree in certain chemical relations: the colouring matter can be abstracted from them by the application of certain solvents; can be still farther transferred from these solvents to other substances, exerting affinities towards it; and this, without it being possible to refer the phenomena to actions exerted by any known proximate principle. But surely this evidence can never be admitted as proof of the existence of a separate principle. If the phenomena cannot be referred to the action of any *known* proximate principle, it may reasonably lead us to conjecture the existence of some such principle; but does it necessarily follow, that this must be colouring matter, distinct from the other constituents of the plant to which it gives colour? The colouring matter of vegetables, it is said, is scarcely ever found insulated, but is mixed or combined with other principles; and that it is obtained in a more simple and pure state by the action of those agents which are capable of dissolving it. But I would observe, that this supposed colouring matter has never, so far as I know, been obtained in a simple state, unmixed with gum, resin, oil, or other known vegetable constituents, which, although it is not a proof of its non-existence, is sufficient to make us cautious in admitting what appears so doubtful. Sometimes the colours of vegetables are extracted by water, which must be cold or warm, according to circumstances; for even in so simple a thing as this, there seems to be a diversity of affinities in this principle. It is not always soluble in water, but recourse must sometimes be had to alcohol, and even, in one instance, to essential or expressed oil. Alkalies and acids, also, must sometimes be employed before its solution can be effected. Now it can easily be conceived, that when it is in complicated combination with resin, gum, tannin, and the like, the operation of different chemical agents may be required, for its separation; but when once the separation is effected, it ought to exhibit common properties, otherwise it can never be esteemed a distinct principle.

It appears, then, that we can receive but little light on the theory of bleaching, from what has been written by chemists, concerning the colouring matter of plants, considered as a distinct, proximate principle, any more than from the vague hypothesis which philosophers have given concerning colour, and coloured light. What is known concerning the operation of the chemical agents used in bleaching, is also founded chiefly on conjecture. When treating of these agents, and of the several processes of the art, I have already given the most probable rationale in the greater number of instances, and shall not now repeat what was then stated. The rationale of the action of the most important of those agents, namely, chlorine, I have reserved for this place.

Berthollet, and most of the earlier chemists of the modern school, if we except Scheele, supposed, that what we called chlorine is a compound substance produced by a union of muriatic acid and oxygen, whence they denominated it oxy-muriatic acid, or oxygenated muriatic acid. This account of the matter is now nearly abandoned by all the eminent chemists of the day, except Berzelius and perhaps Dalton. The most probable account, is that which has been illustrated at great length, and with much ingenuity, by sir Humphrey Davy, and of the merit of which a most preposterous attempt has been made to deprive him by the French chemists, because Gay-Lussac and Thenard, overawed by the authority of Berthollet, *argued against it* in their '*Recherches Physico-Chimiques*,' while all the time they secretly believed it to be just. But if so, why did they not publicly say so, in contempt of Berthollet's authority?

It will be proper to state, as briefly as possible, the reasons for considering Davy's theory to be the most plausible, if not the true, account of the substance. Not the least striking of these is its conversion into muriatic acid, by union with hydrogen, while, during the change, it evolves no aqueous vapour. Sir H. Davy, and Dr. Henry, have satisfactorily proved that water is an essential ingredient in muriatic acid, as the latter has never been procured in an insulated, elastic form. Berthollet makes the proportion of water as high as 34 per cent. but it is probable, that at a minimum, the proportion may be 25, as stated by Gay-Lussac and Thenard. This view of the subject is opposed by Dalton. (*Chem. Phil.* i. 282.) He argues, that when the gases which are not readily absorbed by water, are brought into contact with it, and exposed to heat, a portion of the fluid will be raised into their interstices; but if acids in the state of a gas which can be absorbed by water, readily, and in quantity, are placed in similar circumstances, there is a mutual attraction, and their consequent union produces an acid in the liquid form. It follows, he thinks unanswerably, that these acid gases of which the muriatic is one, so far from obstinately retaining their vapour, cannot be induced to admit any vapour at all in ordinary circumstances. But in making his experiments, Mr. Dalton does not seem to have been aware, that his muriatic gas was previously saturated with aqueous vapour, as it unquestionably must have been, and could not, on this account, admit the absorption of an additional quantity. Would Mr. Dalton affirm, that muriate of lime contains no water of crystallization, because when a very small portion of water is added to its crystals, they become liquid? Now, when it is recollected, that one cubic inch of oxygen, by union with very nearly two cubic inches of hydrogen, forms a quantity of water, whose weight is to that of the real muriatic acid contained in two inches of the acid gas, as 26 to 100, we must conclude that the oxygen of the chlorine, if it contains any, most unaccountably disappears; or, rather, that it has no existence. Dalton has reasoned against this very plausibly, and supported his arguments by ingenious experiments, but he has been satisfactorily answered by Mr. Henderson in a learned paper, for which he received a medal from the Royal Medical Society of Edinburgh.

Again, chlorine, when caused to exert its action on metals, and inflammable substances, produces bodies which are essentially different from oxides produced from the same substances. The most satisfactory proof of this position has been brought forward by Mr. J. Davy, in a paper on the metallic combinations of chlorine. (*Phil. Trans.* 1812, 169.) He combined it with copper, tin, iron, manganese, lead, zinc, arsenic, and bismuth, in most cases in several proportions, but in no case did he obtain any substance resembling the oxides of the same metals. In examining Mr. J. Davy's experiments, Henderson has stated a curious coincidence of the new and the old theory. Horn-lead, he remarks, is said by Mr. J. Davy to contain 74.22 lead, and 25.78 chlorine. According to Kirwan's Analysis, it has 76 of lead, and 18.23 of muriatic acid; which, by the new theory, can yield only 17.6 of chlorine. In this case, the proportions of lead seem to answer very well; but that of chlorine is over-rated, by 8.18 per cent. By Kirwan's Analysis also, horn-lead contains 5.77 of oxygen, which, on the principles of the old theory, is sufficient to form 25.64 of oxy-muriatic gas, by union with muriatic acid. Is this, he asks, merely accidental?

The opponents of the new theory, confess, that the strongest circumstance in its favour, is, that charcoal is neither capable of decomposing chlorine gas, nor muriate of silver, at any temperature whatever; in which cases, the strong affinity of the charcoal, for oxygen, ought to come into play, where oxygen is present in the chlorine, or its compound. This plain, and one should suppose unanswerable, fact, is opposed, not by one equally plain and satisfactory, but by general reasoning on the known laws of chemical combination. Berzelius, (*Ann. of Phil.* ii. 256.) remarks, that the most simple explanation is not always the most accurate. If, indeed, we suppose that the radicle of muriatic acid has a stronger affinity for oxygen than charcoal has, there is no difficulty in explaining the want of action of charcoal on chlorine. But this supposition is evidently quite gratuitous, and can never be allowed to weigh in argument against an indubitable fact. The objections of Berzelius also, which are derived from the general chemical laws which he has established on extensive inductions, must be set aside; for it is contrary to every legitimate mode of philosophizing, to cause nature to bend to any artificial arrangements, which even the most eminent and profound philosophers may see cause to lay down. Nay, Dr. Thomson says that he can point out a complete agreement between those laws of Berzelius, and the theory of Davy. (*Ann. Ph.* vii. 27.) He has not, however, published such an explanation, and I am too young a chemist to be able of myself to perform what appears so arduous a task. But I have full confidence in the assertion of Dr. Thomson, as his known character as a chemist induces me to rely on him. I think, then, that I am justifiable in stating, that the account of chlorine given by sir H. Davy is, if not the truth, by far the most probable which has been published.

We shall now close by considering the effect of chlorine in destroying colours, in the processes of bleaching. Berthollet (*Ann. de Chim.* ii.) supposes that it destroys colours by parting with its oxygen, which unites with the colouring matters, and produces their decomposition, either in a gaseous state, in which case they were carried away by their volatilizing, or in a liquid form, which the dash wheel could readily remove. Davy's explanation, however, is the more probable in so far as his theory of chlorine is so. He thinks, with Berthollet, that colouring matter is destroyed by uniting it with oxygen; but he thinks that the oxygen is wholly derived from the water which is always present in the chlorine preparations. This water is decomposed by double affinity; namely, that of hydrogen for chlorine, and that of colouring matter for oxygen. The virtue of chlorine, then, seems to consist in its power of detaching oxygen from the water contained in the oxy-muriates of lime, magnesia, &c. The chief circumstance, therefore, to which the bleacher should direct his attention in using the oxy-muriate, is that the salt which remains after the abstraction of the oxygen, should not act upon the fibre as it undoubtedly will, if not carefully managed.

Nothing could be easier than to extend these discussions, but as they are at best but vague conjectures, I consider that practical bleaching would receive but little advantage from prolonging them, and the chemical bleacher would assuredly rise dissatisfied from their perusal.

ON GILDING.

We now commence the account of the art of gilding upon metals, by means of an amalgam of gold with mercury; according to the method pursued in France. This article as given in the *Dictionnaire Technologique*, is too long to be completed in the present number, and too important to admit of much abridgment; the remainder, therefore, is necessarily reserved for the first number of the next volume.

This species of gilding, by the English called *water gilding*, is performed upon several different metals, and alloys, as upon silver, copper, brass, and pinchbeck; which latter is an alloy of copper and brass, or of copper with a smaller portion of zinc, than enters into the composition of brass. This alloy, as well as that of copper and tin, the French denominate bronze, whilst we, in general, restrict the latter term to compounds of copper and tin, only. In gilding upon metals, the colour, beauty, and quantity of gold required, depend much upon the nature of the alloy upon which it is laid; that which consists principally of copper and zinc, is to be understood in the following article, where bronze is named.

GILDING UPON BRONZE.

The art of gilding upon bronze has been perfectly described by M. D'Arcet, in a memoir on the art of gilding on bronze, which, in the year 1818, obtained the prize from the Academy of Sciences. From this memoir, we will now extract as much as shall appear necessary to describe the art, and to make known the improvements, which M. D'Arcet has introduced in the mode of conducting it. Those who wish for further details, we must refer to the original memoir.

The art of the gilder consists in the application of gold over a surface of bronze, by the assistance of mercury, with which the gold is amalgamated; the mercury is evaporated, and the gold fixed, by the application of heat; it is then *burnished*, or left *mat*, in whole, or in part, according to the nature of the work.

The gold should be pure, or very nearly so; it should be made very thin, either by the hammer, or the flatting mill, to expose a large surface, and favour its dissolution by the mercury. The mercury employed should also be perfectly pure, as the impurities which it contains, will otherwise be deposited with the gold, on the surface of the bronze, and consequently deteriorate the work.

Preparation of the amalgam of gold.

The workman, after weighing the fine gold which is to be amalgamated, puts it into a small crucible, which is placed in a charcoal fire, on the bed of the forge; the crucible is heated to a light red, and the requisite quantity of mercury thrown in; the mixture is stirred with a small iron rod, bent for the purpose, suffering the crucible to remain for a few minutes upon the fire, until it is known that the combination is effected: the amalgam is then thrown into a small pan containing water, and carefully washed, by squeezing it with the thumbs against the edges of the vessel, allowing all the running mercury to escape, which can be in this way separated. The amalgam which adheres together, so as to be capable of sustaining the impression of the finger, must be protected from dust, as it is that which is to be used in gilding, in the manner to be described.

The larger the proportion of mercury in the amalgam, the thinner will be the coat of gold deposited on the article to which it is applied, and *vice versa.* It is easy to conceive that amalgams may be formed of various proportions; the ordinary composition, however, is formed of 8 parts of mercury, to 1 part of gold. The mercury in this case is in excess, for after straining it through chamois skin, so much is separated as to leave in a hundred parts,

Mercury,	33
Gold,	67
	100

The running mercury which is separated by the pressure of the fingers, contains a considerable portion of gold in solution; it is an amalgam with a large excess of quicksilver, and is used either in making fresh amalgam, or in giving a coat to such articles of brass as are intended to be very lightly gilt.

Among other precautions to avoid injury to the workman, he should be careful to compress the amalgam with chamois skin, and to wear leather gloves during the operation.

Preparation of the Nitric solution of Mercury.

The prepared amalgam is applied to the work by the aid of nitric acid, holding a small portion of mercury in solution. The following is one of the methods recommended by M. D'Arcet. Into a glass matrass put 3¼ troy ounces of mercury, and 4½ of pure nitric acid, of 36° (sp. g. 1.333;) the matrass is to be placed under a chimney with a strong draft, and suffered to remain until the solution is complete.

This is to be poured into a bottle, and 11 and a half wine pints of distilled, or rain water, added to it, agitating it well, and preserving it for use.

Gilding.

After these several preparations have been obtained, the gilding is effected in the following manner.

1st. When the work has been completed by the turner, or the chaser, it is to be *annealed*, for which purpose it is placed upon lighted charcoal, and surrounded with the same, or, in preference, with cakes of tan, which affords a more equal and less intense heat; it is to be completely covered in order to prevent oxidation. It is to be carefully watched, to prevent the thinner parts from being more highly heated, than those which are thick; this operation is best performed in a dark place. When the piece has arrived at a cherry red, the workman removes the coals, and, with a pair of long handled tongs, places it where it will cool slowly.

2. *Pickling and Dipping.*—The design of this operation, is to remove from the bronze, the coating of oxide, with which it has become covered in *annealing.*

The piece is put into a wooden or earthen vessel, containing sulphuric acid, very much diluted with water; it is there left until the oxide is entirely dissolved, or at least softened, when it is to be rubbed with a rough brush; when the piece has been well pickled and washed, it is to be dried. The surface will be still discoloured, and it is to be dipped into nitric acid of 36° of Baumé (sp. g. 1.33,) and rubbed with a long haired brush; this exposes the metallic surface, but does not render it sufficiently clear: in order to obtain a fine metallic lustre, it is dipped into nitric acid of the same strength, into which is thrown a little soot, and common salt. This last circumstance induced M. D'Arcet to apprehend, that the cleansing might be effected perfectly, by using sulphuric and muriatic acids, instead of nitric acid, which last attacks the pure copper with much greater ease and force, than these two acids. In every instance, he observes, the dipping, when well performed, ought to dissolve nothing more than the oxide formed on the surface of the piece, during its annealing, and not attack the metal itself in any degree, which it is difficult to prevent, when the dipping is performed with nitric acid.

The dipping having cleaned the surface, the piece is to be carefully washed in a large portion of water, and rubbed in bran, or in the saw-dust of some wood which is free from resin; this will dry it perfectly, and prevent the tarnishing of the surface from humidity. The piece ought now to appear bright, and perfectly free from oxide; the metallic surface should be every where perfectly seen, and should exhibit a fine pale yellow colour; it should also appear grained, or lightly matted. If too smooth, the gold will not readily adhere, and if too deeply matted, the gilding will require a quantity of gold which will render it too expensive.

3d. *Application of the Amalgam.*—The piece being prepared as directed, is ready for the application of the amalgam, which should be put into a flat earthen dish, which is unglazed, and of a rough surface; a *gilder's scratch brush,* or a pencil made of fine brass wire, is to be dipped into the solution of mercury in nitric acid, of which we have already spoken.

The scratch brush is then pressed upon the amalgam, which by giving the earthen dish a slight inclination is left on its side; by drawing the scratch brush towards himself, the workman charges it with the desired quantity of amalgam, which is then applied to the article intended to be gilt; this is to be spread carefully over the work, dipping the scratch brush again into the acid solution, and into the amalgam, should this be necessary. A skilful workman will deposit a larger portion of the amalgam, on those parts where it may be desirable to gild with greater strength.

The piece is then to be washed in a large quantity of perfectly clean water, and which has not been used for previous washings; it is then dried, and carried to the fire to volatilize the mercury. Should the first coating of gold not be sufficient, the piece is again washed, and the operation repeated in the way already described.

4th. *Volatilization of the Mercury.*—When the work is properly covered with the amalgam, the gilder places it upon lighted charcoal, turning it about, and heating it slowly to the requisite degree, withdrawing it from the fire with a pair of long handled tongs, held in the left hand, which is guarded from the fire by a thick, wadded, leather glove; with a long haired brush he dabs and rubs the whole surface, so as to spread the amalgam equally, turning it in all directions, for this purpose.

The piece is then replaced upon the fire, and heated with the same precautions as before, until the mercury is completely volatilized, which is ascertained by the noise made by a drop of water, which the workman throws upon it, and also by the time which the drop requires to evaporate. During the operation, he repairs those spots which may be defective, being careful to volatilize the mercury very slowly. When the work is perfectly covered with gold, it is carefully washed, and scratch brushed, in water acidulated with vinegar.

If the work is to be partly burnished, and partly mat, the part which is to be burnished, is to be covered with a mixture of whiting, powdered sugar, and gum, tempered in water. This operation the workman denominates *guarding*. When the workman has *guarded* these parts, he dries the piece, and again heats it sufficiently to drive off any mercury which may yet remain; this he perceives by the colour which the work assumes, and by the blackening of the coat of *guarding*. After this he plunges it, whilst yet warm, into water acidulated with sulphuric acid, washes it, wipes it dry, and burnishes it.

5th. *Burnishing.*—This is effected by rubbing the piece with burnishers made of *hæmatite* or blood-stone. The burnishers are dipped in vinegar and water, and the work, in burnishing, always rubbed in the same direction, passing the instrument backward and forward, until the required lustre is obtained. When the burnishing is completed, the piece is washed in cold water, wiped with fine linen, and gently dried upon the bars of a chafing-dish containing lighted small coal.

6th. *Matting.*—The parts to be burnished, if such there be, having been covered with the *guarding*, the piece is attached, by fine iron wire, to the extremity of an iron rod; it is then highly heated, until the *guarding* becomes brown, in consequence of the roasting of the sugar, and the scorching of the gum which enters into its composition. The gilding will thus acquire a fine gold colour; it is then to be covered with a mixture of common salt, nitre, and alum, liquefied in the water of crystallization which these salts contain; the work is again carried to the fire and heated, until the saline coating becomes of a homogeneous texture, nearly transparent, and is in a state of real fusion; the piece is then withdrawn from the fire, and suddenly plunged into cold water, which will remove the saline coating, and also the *guarding*. The work is afterwards dipped in very weak nitric acid, washed in abundance of water, and dried, either by exposing it to the air, warming it upon the chafing-dish, or gently wiping it with clean, dry linen.

[TO BE CONTINUED.]

ESSAYS ON LITHOGRAPHY.—No. V.

MANNER OF PROCEEDING IN EXECUTING WORK OF DIFFERENT KINDS UPON STONE.

Autographic processes.

We have said, that the autographic process, consists in transferring a writing or a drawing, to stone. To effect this, the drawing or writing, is made with ink, on paper; both, prepared in the way we have described. A crayon drawing may, on an emergency, be executed autographically; but this mode of procedure is too imperfect to admit of procuring, by its means, neat and perfect proofs. Besides it is as expeditious to draw immediately on the stone.

In order to write, or to draw on autographic paper, a little of the ink, of which we have given the composition, is diluted in water; taking care to use only rain water, or such as will readily dissolve soap. The dissolution is facilitated by slightly warming the water in the cup; and the ink is dissolved by rubbing the end of a stick of it, in the manner practised with Indian ink. There should be no more dissolved at a time, than will be used in a day; for it does not re-dissolve so well, neither is the ink so good, particularly for delicate designs, after it has been left to dry for several days. This ink should have the consistence of rather thick cream, so that it may form very black lines on the paper; if these lines are brown, good impressions will not be obtained. A sheet of white paper is placed under the hand, while writing, in order that it may not grease the autographic paper.

The stone used for autography, should be polished with pumice stone; and the impressions will be neat, in proportion as the stone is well polished. Autographic work may be executed either cold or warm; that is, either taking the stone at its ordinary temperature, or making it warm by placing it near the fire, or exposing it to the heat of the sun; if the first means of warming it be used, care must be taken that the fire is not too hot, or it will crack the stone: the temperature given to it should be about that of an earthen vessel filled with lukewarm water. The work may be done, though less perfectly, without warming the stone.

When the stone is thus prepared, it is fixed on the press, and the paper on which the writing is made, is applied to it. The stone may be rubbed with a linen, slightly moistened with spirits of turpentine; and in every case it is necessary that it be made perfectly clean. The turpentine is left to evaporate; and from five to eight minutes before the paper is applied, it is wetted, with a sponge and water, on the reverse side to that on which the writing is done, so that the moisture may penetrate throughout every part. The water, however, must not appear on the paper when it is about to be laid on the stone; but any superabundance which may remain on it, must be removed by a pressed sponge. When the paper is brought to the proper state, it is taken, by both hands, at one of its extremities, and placed lightly and gradually on the stone, so that there may be no plaits formed in it, and that it may be equally applied over its whole surface. Care must be taken so to fix the scraper, that it may bear steadily on the autographic paper, for if it removes it at all, it will change the place of pressure, and the lines will be doubled. There should be ready at hand, five or six sheets of very even mackle paper, so that they may be changed with each impression. The paper on which the writing or drawing is made, being placed on the stone, it is covered with a sheet of mackle paper, and subjected to a slight action of the press, then to a second, a third, or even to more, until it is believed that the writing is perfectly transferred. At each stroke of the press, the mackle paper, which has imbibed moisture, is withdrawn, and a dry sheet substituted in its place. All these operations require to be performed with expedition and dexterity; particularly when the stone is warm. The next thing is to detach the autographic paper, which will be found adhering closely to the stone. To effect this, it is well wetted with a sponge, so that every part of it may be perfectly penetrated by the water; it may then be removed with facility, entirely detached from the writing, which will remain adhering strongly to the stone. If this operation, which requires some practice, be well performed, there will not be found the slightest trace of ink remaining on the paper. Should there be any lines not well marked on the stone, they may be retouched with a pen; or, which is better, with a hair-pencil and ink: but when this is done, care must be taken that the stone is quite dry.

A part of the sizing of the paper may be found dissolved, and adhering to the stone; this may be removed by washing, or slightly rubbing it with a wet sponge. The stone is then prepared with aqua fortis, and the impression taken in the way we shall describe in another number of this journal.

Autography is not confined to the transferring of writings or of drawings done with autographic ink. By its means, a transfer may be obtained from a sheet of ordinary printed paper, and with such exactness, that it would be impossible, excepting to well practised eyes, to perceive the least difference between that printed in the usual way, and that which was the result of the autographic process. This mode is very useful when it is desired to unite oriental characters, which we may not possess, with words, phrases, or lines, composed in our ordinary typography. We have thus executed many pieces in which the French, or the Latin language, was intermixed with words, or phrases, in Chinese, or Arabic. We have, in the same way, executed a typographic map, in which all the details were lithographic, while the names of places were at first produced by typography, and afterwards by autography. This operation is begun, by composing, and arranging, in a typographic form, the words, the phrases, or the lines, as they ought to stand. The autographic paper is printed on by this form, and the words in the oriental languages are afterwards written in the spaces which had been left for them. The whole is transferred to a stone, which is prepared for the purpose, and from which the impression is taken, in the usual manner. The same mode is pursued in making geographical maps. After having printed the names, on autographic paper, the other parts of the map, but without the names, are drawn immediately on the stone; and after having printed the names on white paper, the map, drawn upon the stone, is printed on this same paper.

Maps, or line engravings on copper, where the work is not very close, may be multiplied in a similar way. For this purpose, the plate of copper is covered over with the autographic ink, diluted to a convenient consistence. Instead of the autographic ink, a composition is sometimes used, made of one ounce of wax, one of suet, and three ounces of the ink with which the ordinary impressions in lithography are taken. The whole is warmed and mixed well together, and there is a little olive oil added to the composition, if it is not liquid enough to spread itself over the plate. The plate ought to be warmed as usual. After having taken the impression in the rolling press on a sheet of autographic paper, the transfer may be immediately made on the stone, after having rubbed it with a sponge, dipped in turpentine. It is necessary to give three, four, or even more, strokes of the press, increasing the pressure at every successive stroke; the other processes, which we have already described, are likewise to be followed. It is well to wait twenty-four hours before *preparing* the stone, in order that it may be better penetrated by the transferring ink; it is then gummed, and washed, and is ready for use.

This process, which has not yet come into use amongst lithographers, merits the attention of artists: for it affords the means of reproducing and multiplying geographical charts, and some kinds of engravings, indefinitely; so that they might be furnished at a quarter of their present actual value. In fact, all those which are done in lines, or those in which the shadows are boldly executed, are capable of reproducing good impressions by means of autography. The operation becomes extremely difficult when it is necessary to transfer fine line-engravings; the lines of these are so delicate, and so near to each other, that they either do not take well on the stone, or are apt to be crushed and confounded together, by the effect of the pressure. Much practice and address are necessary to obtain tolerable impressions; and this part of the art requires improvement. We have, however, succeeded in transferring to stone, a small, highly finished engraving, which had been printed on common half-sized paper. After having dry polished a stone, very perfectly, we warmed it, rubbed it with spirits of turpentine, and applied the engraving to it. This, however, had been previously dipped into water, then covered, on the reverse side, with turpentine, passed again through the water, so as to remove the superfluous turpentine, and then wiped with unsized paper. In this state, the engraving, still damp with the turpentine, was applied to the stone, and submitted to pressure, when it afforded us very good impressions; the *preparation* not being applied until it had remained on the stone for twenty-four hours. The difficulties increase, of course, in proportion to the size of the engravings which it is desired to transfer to the stone.

Attempts have been made to transfer old engravings; they have, however, succeeded but imperfectly: it would be rendering an essential service to the art, to discover a mode of reproducing old engravings by means of autography; the thing presents great difficulties; still, from the attempts of the kind which we ourselves have made, we think it possible to succeed. It shall suffice us, at present, to give some account of the mode we pursued. The ink of old engravings being brought to a state of complete dryness, it is necessary to give it a body, and unctuosity. To effect this, the engraving may be well soaked in water in which some soda, sal ammoniac, or salt of sorrel, has been dissolved. The engraving is then stretched out on a plank, and spirits of turpentine spread over it; pressing it in with the finger, or the palm of the hand, so that the lines of the engraving may be perfectly impregnated with the turpentine: it is then laid on a warm stone, submitted to pressure, and removed from the stone by wetting it with water. If the engraving has been made too wet, it should be gently pressed between some sheets of unsized paper, before placing it on the stone. It should be inked afterwards with the roller, or, which is better, with the *retouching ink*, of which we have given the composition. For this purpose a printer's ball is used; these are made of wool, and covered with thin, untanned leather.

The autographic process presents great advantages in a variety of circumstances, and in different kinds of work; particularly when economy and expedition are necessary. It is especially adapted to the circulation of all such writings as require an immediate publication; such as advices relative to commerce or to private or public interests; to memoirs, or to scientific, or literary communications, &c. which are only intended for a small number of persons; any one might have a press and use it by himself, or with the assistance of his agents, or his servants. In this manner, and in a way the most economical, geographical charts, geometrical figures, and every kind of design made with the pen, might be produced. Authors who have any knowledge of drawing, might themselves execute their works on autographic paper, without having recourse to artists: for it requires a certain apprenticeship to be able to write or to draw, backwards, with ink on a stone.

On Grinding and Polishing Lenses, for Optical Purposes. By THOMAS GILL, Esq.

FOR the knowledge of the following valuable manipulations, we are indebted to an old and experienced workman, formerly in the employ of the celebrated Mr. Tully, of Islington.

Of the Gauges for Convex and Concave Grinding-Tools.

The mode of forming these is truly ingenious. A glazier's diamond being fixed near one end of a bar of wood, in the proper situation for cutting, holes are made through the bar at proper distances, according to the lengths of the foci of the intended lenses, and a piece of crown window-glass, being secured firmly upon a table or work-bench, a brad-awl is passed through one of the holes in the bar, and affixed in the table, as a centre; and the piece of glass is then cut through with the diamond, thus forming correspondent convex and concave gauges at once. The edges of these gauges are then rubbed or ground against each other in the following manner. One of them being securely held upon a table which is wetted with a mixture of emery and water, the other is rubbed against it, continually changing their sides and ends, until the curves are perfected. The workmen generally prefer, for this purpose, those pieces of crown glass which have upon them parts of the smooth rounded edges of the semi-circular plates of glass.

Of the Patterns for Casting the Grinding-Tools.

A convex and concave pattern is turned in well-seasoned wood, to the exact curves of the gauges, of a proper thickness for the tools, and having short cylindrical stems at their backs, for screwed holes, which are to fit upon the screwed arbor or mandrel of the lathe.

Of the Grinding-Tools.

From each of these patterns, a cast-iron and a brass tool must be formed; and screwed holes being made at their backs, to fit upon the lathe mandrel, their surfaces must be carefully turned to the gauges. In order to remove the marks of the turning tools, pieces of old broken flat files are laid in, or upon, one of the surfaces; the backs of the pieces of files having previously been coated with a sufficient thickness of the cement to be afterwards described; the other corresponding convex or concave grinding-tool, must then be heated over a fire, until it will cause water dropped upon it, to hiss or form air-bubbles; when it is to be applied to the cement on the pieces of files, and be immediately cooled, by wiping its back all over with a sponge wetted with water. The pieces of files are then to be worked, or rubbed over every part of the turned surfaces, to bring them nearer to truth; and, finally, blocks of lenses must be ground in them, to perfect them, in the manner to be hereafter described.

To Prepare the Glasses for Grinding.

These must be chosen of the proper thickness and quality of glass, as free as possible from veins or blebs; and be clipped (or *nibbled*, as the operation is termed,) by means of well-known iron instruments, into equally-sized circular pieces. Seven of these are usually ground at once; viz. one in the middle, and the others surrounding it. Before finishing them in the brass tools, however, they are rough-ground on the cast-iron tools singly; in order to which, their backs are coated with cement, to a sufficient thickness to form handles to hold them by, by pouring the melted cement from an iron ladle upon them in succession, as much at a time as will conveniently lie upon them without running off, and renewing these coats till the required thickness is obtained.

These are then worked in, or upon, the cast-iron tools, with the assistance of that kind of emery termed by the makers, No. 2, *corn emery*, and water, until their surfaces shall have become nearly convex or concave; the tool is placed in a shallow wooden trough, to catch and retain the emery, which is afterwards washed over, (in the manner to be described,) to finish the grinding.

Of the Cement for fixing the Glasses on the Grinding-Tools.

This cement is made of common pitch and sifted wood-ashes, melted together in proper proportions to give it a due consistence, according to the temperature of the weather.

On finishing the Grinding of the Lenses.

The rough-ground glasses being placed in the manner above described—with their faces in, or upon, the surface of one of the brass grinding-tools (the cement on their backs having, however, been previously reduced to an exact thickness, and flattened, by a heated flat-iron applied to each, singly)—one of the cast-iron tools is heated in the manner before mentioned, applied to the cement on the backs of the lenses, and instantly cooled, as above directed. Great care must be taken, in placing the seven glasses in, or upon, the brass tool, to fix the best piece of glass in the centre, as that will form the most perfect lens; and also to see that no two of the other glasses are in contact, but are a little removed from each other. They are now ready for finishing the grinding.

On the Preparation of the Emery, by Washing Over.

The emery used for rough grinding in the cast-iron tools, is washed over, so as to separate it into six different degrees of fineness, in the following manner:—

It is put into a large earthen-ware vessel, which is nearly filled with water, and being stirred up, is left to repose for the space of one quarter of a minute, and is then poured off into another large vessel; and so on, in succession, according to the following periods, viz.—

No. 1. One quarter of a minute.
2. One minute.
3. Two minutes.
4. Six minutes.
5. Fifteen minutes.
6. Thirty minutes.

After having stood the proper time for each degree, the emery deposited in the large vessels is put into small earthen vessels, which are carefully covered over with paper caps, to guard against the entrance of dust; and are marked from No. 1, to 6.

Of the Stand and Handle for the Grinding-Tools.

A well-framed stand, of a proper height, and not too wide at its base, must be provided. This is to be firmly screwed to the floor of the work-shop. On its top a cast-iron block is to be affixed, having upon it a male screw, exactly similar to that upon the end of the lathe mandrel; and upon this, the female screw at the back of the brass tool is to be screwed. Into the female screw at the back of the cast-iron tool, a handle, made of *lignum vitæ*, or other hard wood —of the form of a bulb, or an oblate spheroid, of a convenient size to be readily grasped with the hand, and having a male-screw made to fit—is to be put. The tools will now be ready for work; and the operation must be performed in the following manner:—

On the Manner of Grinding in the Tools.

A little of the washed emery No. 1, mixed with water to a thick consistence, is to be taken out of the vessel with the fingers, and to be spread pretty uniformly over the surface of the brass grinding-tool. In order, however, still more to equalize it, and prevent it from lodging in lumps, a piece of glass which had been previously ground, of the same curvature as the tool, is to be worked in it; and the outer edge of the tool is also to be freed from the emery with a wet sponge. The block of lenses is then to be placed in or upon the brass tool, and the grinding proceeded with as follows:—The workman takes hold of the handle of the block with his right hand, and gives it a long oval movement across the tool, carrying it a little beyond its edge; and, every second stroke, giving the block a twist with his left hand; at the same time gradually walking round the stand, backwards and forwards alternately, so as to give every part of the tool an equal chance of wear. In case the block moves too stiffly, a little water should be sprinkled over the surface of the tool; and as soon as the emery is clogged with the glass, and ceases to cut, it must be wiped off, with the moistened sponge, both from the tool and the lenses; carefully observing that none is suffered to lodge in the spaces between the lenses. The next degree of the emery is then applied in the same manner; and so on, till each has done its office. No. 6, however, is to be applied twice, in order to bring the lenses to a better and finer surface for polishing. If, however, during the operation, any scratches are found to appear on the lenses, even when viewed with a magnifier, the operation of grinding must be repeated. Great care ought also to be taken to wash the sponge clean from the different sorts of emery during the process.

To Polish the Lenses.

A tool is to be heated and coated with cement; and for large lenses it must be lined with a thick woollen cloth, made on purpose; for smaller ones, with ordinary woollen cloth; and for still smaller, with kerseymere: either of these, as the case may require, is to be applied upon the heated cement, and then be worked in or upon the lenses affixed to the block, till it has assumed their curvature. The pores of the cloth are then to be filled up with No. 6, washed emery and water (or the finest sediment which will in time be formed in the tub, in which the sponge, after wiping the grinding-tools, is continually washed,) to bring it to a uniform surface; and when cooled, putty, or the combined oxides of tin and lead, is shook uniformly over it, from a tin box with a lid perforated with holes, and a little water is sprinkled upon it. The polishing then commences:—but the strokes are now made backwards and forwards directly across the tool, not in oval sweeps as before; and the other directions must be particularly attended to.

When both sides of the lenses have been ground and polished, in the manner described, they must be finished separately. This is termed *rectifying* them.

On Rectifying the Lenses.

In order to perform this operation, SMALL TOOLS must be cast of the following compound metal, viz.

Lead, one pound;
Regulus of antimony, eight ounces.

This composition admits of being readily turned in the lathe, with tools wetted with water.

In order to form the tools, a hole must be turned in a piece of wood, to the shape the tool is to be made of; namely, with a round, flat surface, large enough to hold the lens when cemented upon it, and with a stem at the back, to contain a female screw, which is to be cast in them thus: The mandrel of the lathe is to be placed in the middle of the hole made in the piece of wood, and the melted compound metal must be poured into the mould thus formed. When cold, the tool is to be finished in the lathe by turning it, and its flat face must be roughened by making scratches across it in every direction, the better to retain the cement upon it.

Of the Cement for Rectifying the Lenses.

Pitch, one pound;
Bees-wax, one ounce;

melted together, and strained through a cloth.

Two of these tools, being coated with this cement whilst it is warm, are to be applied successively to the wetted surfaces of the lens, so as to take its curvature or curvatures exactly: the cement must, however, previously have two gaps or furrows made through it, to the surface of the metal tool; and these must again be crossed by two others, for the extraneous polishing material to lodge on.

The lens will readily adhere to either of the surfaces formed of the cement, by merely breathing upon it, and can easily be removed again; which is absolutely necessary in this operation of rectifying it.

The polishing, or rectifying, is effected with the finest washed putty, applied upon one of the faces formed of the cement, whilst the lens is held upon the other: and the putty is put into a phial with water, and that only which remains suspended in the water, after being stirred up, is employed.

On Centring the Lenses.

This is effected by affixing the lens upon the end of the hollow mandrel of a lathe, coated with a ring of cement, whilst it is warm; and an object being placed before the lens, and a proper sight-hole provided at the opposite end of the mandrel, the mandrel is to be turned slowly round, and the lens shifted until the object appears steady when viewed through it. When the cement is cold, the lens is to be turned circular in the lathe, by applying a cutting diamond to it. [*Technical Repository.*

FRANKLIN INSTITUTE.

Report of the Committee of Premiums and Exhibitions, on the fourth Annual Exhibition.

The committee of premiums and exhibitions of the Franklin Institute of the state of Pennsylvania, for the promotion of the mechanic arts, submit the following report, viz.

The fourth exhibition was held at the Masonic Hall, on Thursday, Friday, Saturday, and Monday, the 4th, 5th, 6th, and 8th inst. (October;) the committee of arrangement having deemed it expedient, from the unfavourable state of the weather, to defer the opening of the exhibition one day later than the time announced in the address to the public.

The committee have the satisfaction to report, that the display of American ingenuity and industry justifies the most sanguine anticipations of those who instituted these exhibitions. Every succeeding year brings before the public, articles of manufacture before unknown, which, in the intervening space, have advanced so rapidly, as to warrant the belief, that time and experience only, are requisite to place them beyond the reach of foreign competition. The advantages of these exhibitions thus successively present themselves in stronger characters; an honourable spirit of competition is apparent in the improvement manifestly created by them, and in the public patronage which they secure to the Institute. Notwithstanding the barrier interposed by your prudence to prevent an excessive crowd, by requiring a small fee for admission from those who are in no way contributors to the Institute, the rooms were at all times well filled, and frequently so crowded as to render repeated visits necessary in order to gratify the curiosity of many, to the extent of their wishes. Your committee, therefore, recommend the continuance of this salutary arrangement, so well calculated to promote the interests of the Institute, and at the same time to gratify those from whom the money is received.

Your committee have much cause to regret, that a disposition to procrastinate is still manifest among the contributors to the exhibition; and that it has prevented them from having the satisfaction of conferring many premiums, which the excellence of the articles, and the favourable opinions of the judges, would have awarded to them, had they been received at the time specified. They hope that the disappointment experienced by many from this cause, will induce them, hereafter, to apply the remedy which a little forethought will supply.

Your committee recommend that the friends of the Institute be invited to send communications to their secretary, A. G. Ralston, Esq., specifying any article which they may deem worthy of notice, and furnishing such information as they may possess, to aid them in framing the list of premiums for the next annual exhibition.

Your committee deprecate the prevalence of a feeling which has prevented many meritorious artizans from exhibiting specimens of their *ordinary merchantable manufactures;* it should be more generally understood, that the object of these exhibitions is not to promote the manufacture of any article, the cost of which would be an insuperable obstacle to its profitable sale, but of such, principally, as are extensively used.

Your committee cannot withhold the expression of their satisfaction for the liberality and candour, and, in general, for the prompt attention manifested by the various committees of judges, whose delicate task has been executed in such manner, as they confidently hope will obtain for them the favourable opinion of the public.

In announcing the premiums which have been awarded, the committee reserve to themselves the pleasure of giving, hereafter, a detailed list of all the articles exhibited, and of bestowing such commendation as their feelings would prompt, and the recommendation of the judges will justify.

Of the sixty-two premiums proposed by the managers of the Institute in their printed circular of the 24th of February last, the committee have awarded 15—as due by the terms of the prospectus, and eight honorary premiums for articles not enumerated.

REGULAR PREMIUMS AWARDED.

Premium No. 3.—"To the maker of the best *instruments for operations on the eye.*"

This premium is awarded to Messrs. Wiegand & Snowden, of Philadelphia, for a case of instruments, No. 12—adjudged remarkably excellent.—*A silver medal.*

No. 7.—"To the person, in the United States, who shall make the greatest quantity of *soda,* not less than five tons."

The premium is awarded to Messrs. M'Kim, Sims, & Co. of Baltimore, for specimen No. 329, being a sample taken from a lot of more than seven tons, manufactured from American materials. It is reported by the committee of judges to be a very superior article, and deserving of particular praise. This soda has been on hand during the late summer, by which its permanence under atmospheric changes was fairly tested—*A silver medal.*

No. 21.—"For the best specimen of the *cutting* of *flint glassware,* of which a variety of articles must be exhibited, and the excellence of form, as well as the quality of the material, will be considered in awarding this premium."

The specimens exhibited were numerous, from the manufactories of Messrs. Bakewell, Page, & Bakewell, of Pittsburgh; of Messrs. Jackson & Baggot, of New York; of the Union Glass Company of Kensington; of the New England Glass Company of Boston, and of Messrs. M'Cord and Shiner, of Philadelphia. They were, with few exceptions, of excellent workmanship, metal, and form, and evinced much improvement in the cutting; an art which has attained to such excellence in this country, that the importation is unnecessary. The premium is awarded to Messrs. M'Cord and Shiner, of Philadelphia; they having exhibited, in lot No. 341, the greatest quantity of articles of excellent workmanship—*A silver medal.*

No. 24.—"For the best specimen of *gig* or *coach harness*, made in Pennsylvania."

In this branch of manufactures, several beautiful specimens were exhibited from Amos Atkinson, Magee & Tabor, &c. of this city; the workmanship, as well as the materials, was generally of a superior character. The premium is awarded to Messrs. Magee & Tabor, for No. 231, being a splendid set of coach harness, in which the leather and workmanship were judged to be better than any other exhibited —*A silver medal.*

No. 25.—"To the maker of the best *buckskin gloves*, the leather to be dressed in the United States, and the gloves to be made in Pennsylvania."

The premium is awarded to Mr. Henry Lye, of Philadelphia, for No. 69, being six dozen pairs of gloves made, and the leather dressed, by himself. The workmanship was good, the leather fair, and that in the horseman's gloves very superior to any exhibited—*A silver medal.*

No. 29.—"For the best specimen of *lithography*, to be executed in the United States."

The premium is awarded to Rembrandt Peale, of Boston, for specimen No. 197, being his beautiful portrait of Washington, executed by him, and printed at the press of Messrs. Pendletons of Boston; esteemed the best specimen of American lithography ever seen by the committee on fine arts—*A silver medal.*

No. 31.—"To the pupil of the drawing school of the Institute, who shall make and exhibit, in October, 1827, the best *specimen of drawing*."

Three specimens were exhibited: a perspective view of the Marine Asylum, Norfolk, by Mr. Campell, of New Jersey. Very correct, and the point of view chosen with taste. Canova's Venus, in oil, by Jefferson Garret; alike creditable to the instructer and the pupil. And a well executed Corinthian capital, by Andrew Young, of Manayunk. Mr. Young was the only competitor who fulfilled the conditions of the premium, and to him is awarded—*A silver medal.*

No. 34.—"To the maker of the best *cabinet book case* and *secretary*."

The premium was awarded to Mr. Anthony Quervelle, of Philadelphia, for No. 250, being a splendid piece of furniture from the establishment of this excellent workman—*A silver medal.*

No. 36.—"For the best *upright* or *horizontal piano.*"

Pianos were presented by Mr. C. Pommer, Mr. Mickley, and Messrs. Loud & Brothers, of Philadelphia, and by Mr. A. Babcock, of Boston. All of which were finished in a manner highly creditable to the makers. The premium is awarded to Messrs. Loud & Brothers, for No. 33, an organized piano, combining the properties of a piano and organ, the latter having two stops, the flute and dulciana, each of a remarkably sweet tone. The piano, as a separate instrument, was strong, full, even, rich, and brilliant, in its tone—*A silver medal.*

No. 42.—"To the manufacturer of the best *flannel* made in Pennsylvania."

The premium is awarded to Mr. John Bancroft, of Delaware county, for eleven pieces of flannel (No. 28) remarkable for excellence in fabric, as well as for cheapness—*A silver medal.*

No. 48.—"To the manufacturer of the best specimen of *calicoes,* or *prints,* for ladies' dresses, made in the United States."

Various articles were presented from the Warren factory near Baltimore; from the Merrimack Company, Massachusetts, and Taunton factory, Massachusetts; all of which manifested much improvement in the art of printing. In the specimens from Warren, the colours were very excellent. The Merrimack undressed prints, were a superior article, and the colours good, but the Taunton goods were deemed the best, in considering the colours, fabric, and printing. The premium is consequently awarded to Messrs. Crocker, Richmond & Otis, of Taunton, Massachusetts, for No. 266—*A silver medal.*

No. 50.—"To the manufacturer of the best specimen of *heavy cotton goods,* fit for labourers' wear."

The premium is awarded to Mr. Hugh Dickson, of Philadelphia, for No. 53, being 21 pieces of drilling at 22 cents per yard; a good and substantial article—*A silver medal.*

No. 54.—"To the maker of the best *loom cotton stockings.*"

The premium is awarded to Mr. George Tupman, of Philadelphia, for specimen No. 25, being five dozen pair, which will undoubtedly prove to be a strong and durable article—*A silver medal.*

No. 57.—"For the best specimen of *porcelain,* to be made in Pennsylvania, either plain white, or gilt."

This is a manufacture of great importance to the country, as most of the capital expended is for labour; the materials being taken from our soil, in great abundance and purity. The highest credit is due to Mr. Wm. E. Tucker, for the degree of perfection to which he has brought this valuable and difficult art. The samples (No. 174) of this ware, were made by him. The body of the ware appeared to be strong, and sufficiently well fired, the glaze generally very good, the gilding executed in a neat and workmanlike manner. Some of the cups and other articles bear a fair comparison with those imported —*A silver medal.*

No. 61.—For the best specimen of *edged tools,* ordinarily used by carpenters, &c. one dozen to be exhibited.

But one competitor appeared, which was Mr. Robert Beatty, of

Village Green, Chester county, Penn. whose tools sustained the high character they have always borne, being superior, in the estimation of the committee, to any similar articles of foreign manufacture with which they are acquainted. The premium is, therefore, conferred on Mr. Beatty.—*A silver medal.*

SPECIAL PREMIUMS.

Many well executed articles were exhibited, for which no premiums were offered; to these the Institute have reserved the right of awarding such honorary premium, or compliment, of which the object may be deemed worthy.

No. 1.—Two *cabinet pianos* were exhibited by Mr. Charles Pommer, of Philadelphia, the keys of one of them were of mother-of-pearl; they were both much, and justly, admired, particularly that made with ivory keys. They were considered inferior to none but the organized piano of Messrs. Loud & Brothers. The committee have, therefore, awarded to Mr. Charles Pommer, as an honorary premium—*A silver medal.*

No. 2.—A large assortment of *floor cloths* was exhibited by their enterprising manufacturer, Mr. I. M'Cauley, of Philadelphia. One piece attracted particular notice, containing 140 square yards, without seam. These cloths are equal to the best imported, and much cheaper. The committee awarded to Mr. M'Cauley—*A silver medal.*

No. 3.—A *map of South America*, by John L. Wilson, a pupil of the High School of the Franklin Institute, evinced much talent in this youthful draftsman; the committee have much pleasure in awarding him—*A silver medal.*

No. 4.—The committee witnessed with great pleasure the improvement, which has taken place in the manufacture of *straw goods.* And while they regret that Pennsylvania has not claimed the premiums No. 11 and 12, for straw plait, they cannot withhold their commendation for the praiseworthy exertions of their neighbours. The importance of the straw manufacture is great, because it employs females and children. The samples of straw bonnets were much superior to any that can be imported at the same price. Those from the Walnut-street school deserve particular praise, as they were made by children of 8 or 10 years of age. Ten assorted *Leghorns* by J. Beacher, Tioga county, New York, evinced much improvement. Some of the bonnets were of very fine texture, viz. No. 52, two *Straw Hats*, by Mary Wright, of Providence, and No. 21, by Mary Lincoln, Taunton, Massachusetts, all of which were beautiful specimens. The committee think the latter deserving of the first place, from the natural and uniform brilliancy of the straw, its freshness, and the evenness of the edge; and awarded to Mary Lincoln—*A silver medal.*

No. 5.—*Gilt Buttons* received from Mr. Richard Robinson & Co., Attleboro, Massachusetts, and deposited by Mr. F. S. Krug; were beautiful specimens of this manufacture, in all points equal, and in some, superior, to the imported. They deserve the highest commendation, and are deemed by the committee worthy of an honorary premium; they, therefore, award to Messrs. Richard Robinson & Co.—*A silver medal.*

No. 6.—To the New England Glass Company of Boston, great credit is due, for their splendid specimen of *Stained Glass*, which, in the opinion of the admirers of the Fine Arts, shows much skill, taste, and enterprise, and compares advantageously with similar modern productions, in countries where the arts have attained greater maturity. They deem an honorary premium due to this company, and, therefore, award them—*A silver medal.*

No. 7.—Two pieces of *Blue Cloth* at 5 dollars per yard, made by Messrs. Kershaw and Dean, of Pennsylvania, were deemed by the committee to be worthy of a premium, on account of the price, which is very low for the quality. It is not pretended that the cloth was equally fine with that exhibited last year, but it was much cheaper:—*A silver medal.*

No. 8.—Messrs. Yale & Co. of Wallingford, Connecticut, deserve much praise for their manufacture of *Block Tin Ware*, which has been carried by them to a state of great perfection; and has nearly superseded the use of Britannia Ware, to which it is in many points superior, as also much cheaper:—to them is awarded an honorary premium of—*A silver medal.*

ARTICLES TO WHICH HONORARY MENTION IS AWARDED.

No. 1.—The *horizontal piano* made by Mr. Joseph I. Mickley, Philadelphia, was entered as a specimen of a plain and cheap instrument, and is deserving of praise. Also a horizontal piano by Mr. A. Babcock, Boston, of an improved construction; the frame which supports the wires being of iron, and sufficiently strong to sustain their enormous tension. This instrument was finished in the best manner, not merely in the exterior, but throughout, and the maker has maintained the high character which he had previously acquired. The tone of this piano is not powerful or brilliant, but remarkable for its uniformity from the lowest to the highest note.

No. 2.—M. William J. Young, of Philadelphia, exhibited a *Spirit Level* and *Surveyor's Compass*, both instruments highly finished, very complete of their kind, and which may be advantageously compared with those imported.

No. 3.—The committee, and, indeed, the visitants generally, were struck with the great improvement that has taken place in the form and workmanship of *Coal Grates*, since the last exhibition. Specimens were sent by Mr. T. Pettit, Mr. S. P. Morris, and Messrs. N. Lloyd and Son, of Philadelphia. They all deserve great commendation, but the committee have expressed so great a diversity of opinion on their relative merits, that they have not felt justified in giving a preference to either of the competitors, but have determined to award to each an *honorary mention.*

No. 4.—Mr. N. Gevelot's *head of Minerva*, executed by him for the Philadelphia Arcade, in terra cotta, does much credit to the progress of the arts in this city. It is not only quite suited to its purpose, being of a very durable material, but evinces power in the artist to execute with success, works of a much higher character.

No. 5.—To Mr. H. S. Tanner, of Philadelphia, for his map *of Virginia,* which, in point of execution, is superior to any thing of the kind heretofore published in this country.

No. 6.—*Slaughter sole leather* was exhibited from the manufactories of Mr. John Ashburner, and Messrs. G. & J. Laws, of Philadelphia; they were both of the very best quality, and the committee of judges were unable to decide which ought to have the preference. The *dry hide sole leather* of Mr. Ashburner was superior to any hide leather exhibited.

Mr. George Wilson's very superior *oil dressed leather* and *parchment,* remarkable for the excellence of the material and workmanship, merit for him, as do the above articles for Mr. Ashburner and the Messrs. Laws, each an *honorary mention.*

No. 7.—Particular notice is due to Mr. John Elliot, of Philadelphia, for No. 62, a specimen of *Bi-carbonate of soda,* a handsome and perfectly saturated salt, containing 49-100 carbonic acid, mild to the taste, and perfectly white; it is the best exhibited.

No. 8.—Messrs. M'Kim, Sims, & Co. of Baltimore, exhibited No. 329, a specimen of *sulphate of magnesia,* which was quite free from iron. These gentlemen, with another manufacturer of Baltimore, have the merit of excluding the English salt from our market, and now furnish a much better article, on lower terms than when we depended on foreign supply.

No. 9.—Specimens of *white lead* were exhibited by Messrs. S. P. Wetherill & Co. and Mr. Samuel R. Wood, both good articles. That from Messrs. Wetherill's manufactory, was adjudged the best, and to them was awarded an *honorary mention.*

No. 10.—The *patent bedstead* of Mr. J. Aitkin, attracted much attention, the construction being peculiar from its having no screws, and being so contrived, that it can be securely put together, and readily taken apart in a very short time. The committee think this plan should be generally adopted.

THE FOLLOWING ARTICLES WERE DEEMED WORTHY OF PARTICULAR NOTICE.

For an admirable *map of Europe, and of the United States,* by Mr. Anthony Finley, of Philadelphia, much credit is due.

Specimens of *Lake and Carmine,* by Mr. Joseph Boston, of Philadelphia, were considered equal to the best imported colours.

A *case of water colours,* by Mr. George C. Osborne, is quite equal to that of last year; the lakes were of an improved quality.

The *green verditer,* by Mr. Thomas Harrison, was the best of the kind exhibited. The *rose pink, blue verditer,* and *Dutch pink,* from the manufactory of Messrs. Harrison and Halsey, of New York, were superior articles.

Paper hangings made by Mr. Andrew Humphreys, of Philadelphia, were of excellent quality, and deserve particular commendation.

Much credit is due to Mr. George Parkinson, for his excellent specimens of *preserved fruit.* They were put up with much skill, particularly the smaller fruits. The brandy fruits were much improved by age.

The committee cannot close this report, already extended much beyond their original design, without expressing their favourable opinion of several articles, upon whose merits the space allotted to them will not permit them to enlarge. Amongst these, are a pair of splendidly cut, *glass decanters*, from Messrs. Bakewell, Page and Bakewell, of Pittsburg. The *Atlantic Souvenir*, for 1828, which reflects the highest credit upon the liberal patronage bestowed upon the Fine Arts, by the enterprising publishers, Messrs. Carey, Lea and Carey. A splendid *side board* and *French secretary*, from Mr. C. P. White. A beautiful and highly finished *flute*, by Mr. Catlin. A pair of *cotton blankets*, from the Eagle Factory, Trenton, and some handsome *dimities*, from the Hamilton manufactory, at Lowell, Massachusetts.

Some articles of great merit are not mentioned in this report, as they were brought into the exhibition after the lists were handed to the judges; and the committee are apprehensive, that others may have been overlooked, for which, they must beg the indulgence of the depositors, it being almost impossible to avoid doing injustice to some, in so extended a catalogue. Should any one feel himself aggrieved, the committee hope that they may have an opportunity of repairing their fault in the detailed report of the exhibition, which will be published as soon as it can be prepared.

Signed JAMES RONALDSON,
THOMAS FLETCHER,
ADAM RAMAGE,
ABRAHAM MILLER,
SAML. J. ROBBINS,
A. G. RALSTON,
Committee.

Philadelphia, October 18th, 1827.

On washing Emery for Optical purposes, &c. *By* M. CHEZY.

IN order to obtain *very fine emery*, and of different degrees of fineness, the sieve is not sufficient, but water must be used. After having well ground the coarse emery on an iron plate, with a muller of the same metal, it is thrown into a vessel, which must be rather wider at bottom than at top, by a gradual increase. The vessel must then be filled with clear water, so that it may stand eight or ten inches above the emery. The whole is then to be strongly agitated with an iron spatula; after which it must be left to settle for an hour. The emery falls to the bottom, but the water remains turbid, being charged with emery, in the state of an extremely fine and light matter. The shortest leg of a syphon, filled with clear water, must be plunged to the depth of four inches below the surface of the emery water; holding the other extremity of the syphon closed with the finger, which is afterwards to be withdrawn, that the water may flow through the syphon, without stirring the vessel, or agitating the emery which is at the bottom of it. The water thus drawn off is to be received into another large vessel, and the first vessel is to be again filled, and its contents agitated as before. The same operation is to be repeated till the water passes clear through the syphon. The powder which passed over with the water, and which was received in the second vessel, is too fine to be usefully employed in grinding glass. The vessel being emptied and cleared, the same operations are to be repeated, with this difference only, that instead of leaving the water to settle for an hour, no longer time is employed than half an hour; and when the water passes clear through the syphon, the operation is discontinued, and the emery obtained by subsidence from the water, and carefully defended from all impurities, is reserved under the denomination of "*emery of half an hour.*"

The same operation being repeated, allowing only a quarter of an hour for the subsidence, affords an emery, which is, indeed, fine, but less so than the preceding, and is to be reserved under the denomination of "*emery of a quarter of an hour.*"

By similar processes, emery may be obtained, of half a quarter of an hour; or of any other length of time which may be desired, as of four, of two, of one, of one half, or one quarter of a minute. To measure the half or quarter of a minute, a pendulum beating seconds (or a weight suspended by a string of 39,2 English inches) may be used. The oscillations are to be counted from the moment of the ceasing of the agitation; and, at the instant of the thirtieth or fifteenth oscillation, the finger being withdrawn from the mouth of the syphon, previously placed in the water, suffers this fluid to flow. The sieve may be used for coarser emery.

Observations by MR. GILL.

We have extracted this article from Nicholson's quarto journal of Natural Philosophy, vol. III. It forms a useful addition to the information we have given in the article, p. 398, on Mr. Blore's (a late workman of Mr. Tulley's) method of washing over emery. We do not think, however, that the finest emery would be of no use in grinding glass; on the contrary, we have found that the glass *greyed* by *the finest emery we could produce*, and applied upon lead, is the best to be employed in the microscope, for removing the false glare produced by the sun's light, or the light of a candle or lamp.

It would be convenient to mount the syphon in a hole made in a flat piece of wood, at the proper height, to reach four inches down below the surface of the water; when the board was laid upon the top of the vessel, the trouble of supporting it at the proper height by the hand, would be thus saved. [*Technological Repository.*

Plan for preserving the Walls of New Buildings from Dampness.

The author considers the introduction of moisture into buildings, as the effect of a capillary attraction. The less time (says he) is taken to finish buildings, the more rapidly does the water penetrate, because when they are not yet dry, they more easily conform themselves to the humidity of the soil which supports them, and the evil is more or less rapid, in proportion as the earth contains more or less nitre or other salts; and even the most impenetrable cements, hitherto employed, cannot prevent, at all points, the ascension of water through the medium of capillary tubes. It would be desirable to cover the whole thickness of the wall, at about two feet from the earth, with an impenetrable substance, and to preserve likewise the lower part of the building from the dampness of the soil.

The most certain method of doing this, would be by means of a layer of sheets of lead, about a line thick, soldered together. If, notwithstanding the absence of air, the oxidation of this metal were apprehended, and the consequent penetration of dampness through the pores of the oxide, recourse might be had to another method, less expensive, and which would equally well answer the proposed end. That is, to spread over the whole thickness of the wall, a layer of pit coal, mingled with pitch or rosin, and powdered charcoal. This material, being soft, would, when loaded with the weight of the building, fill up all the vacuities, and prevent the access of moisture most effectually. [*Bull. des Sciences.*

Lukens's Chronometer Springs.

Mr. Isaiah Lukens, of this city, has invented a mode of hardening the balance springs of chronometers, in a very superior and perfect manner. In the operation of hardening, by the improved process, the polished spring loses scarcely any of its brilliancy; the helical figure is perfectly preserved, and the grain of the steel is evidently less liable to injury than by the old method. The complete protection of the surface, is, indeed, an assurance, that the interior is also preserved from deterioration.

The Editor has been confidentially made acquainted with the process followed by Mr. Lukens, and is not, therefore, at liberty to publish it. Several of the most eminent chronometer makers in England, have adopted it, and have cheerfully rewarded Mr. Lukens for his ingenious discovery, and others will undoubtedly avail themselves of its advantages.

Mr. Gill, who is Mr. Lukens's agent in London, has received the subjoined certificates, which he has published in his Technological Repository.

Royal Exchange, London, Aug. 23, 1827.

Sir—I am happy to bear testimony to the excellence of Mr.

Lukens's new method of hardening steel balance springs for chronometers.

The difficulty of preserving the pristine excellence of the steel will be conquered; and although the result can only be ascertained by a sufficient trial, through the various adjustments, yet I have the strongest impressions on my mind, that it will be crowned with success.—I have the pleasure to subscribe myself, sir, your humble servant, JOHN R. ARNOLD.

1, *Change Alley, London, Aug.* 20, 1827.

SIR—With respect to the process of Mr. Lukens, for hardening chronometer springs, as exhibited to us, its superiority is unquestionable. Whether it may be productive of any other advantage, will require both time and observation to determine.—We are, sir, your obedient servants,

PARKINSON & FRODSHAM.

6, *East street, Red Lion Square, London, Aug.* 25, 1827.

SIR—The best proof I can give of the efficacy of Mr. Lukens's method of hardening pendulum springs for chronometers, is, that I do not intend, for the future, to adopt any other. I have made several, and find them to answer completely according to my wishes.—I remain, sir, your obedient servant,

R. WIDENHAM.*

81, *Great Ormond Street, Queen's Square, London,*
Aug. 24, 1827.

SIR—The mode of hardening chronometer pendulum springs, communicated to me by Mr. Lukens, I consider superior to any I have seen, and another step towards the perfection of these instruments.—I am, sir, your obedient servant,

J. GREEN.

We are much gratified in being able to announce that Mr. Lukens has determined to commence, in Philadelphia, the manufacturing, repairing, and regulating of chronometers; he has, for this purpose, made arrangements with the principal manufacturers in England, which will secure a supply of the best materials of the kind which it may be necessary to import. Those who are acquainted with his skill as a workman, will have the most perfect confidence in his ability to carry his intentions into successful operation. His visit to Europe will thus have secured to his country the honour and advantage of obtaining, at home, instruments of the highest value in a nautical point of view, and which also furnish a most triumphant example of human ingenuity and skill; may the success of the individual equal the importance of the undertaking.

EDITOR.

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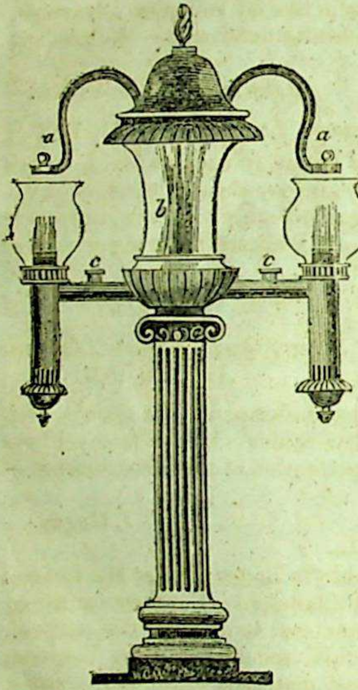
* Mr. Widenham gained the premium of 300*l.* assigned by the Lords of the Admiralty, for the best chronometer, after one year's trial at the Royal Observatory, Greenwich, in the year 1825.

Hon. E. Cochrane's *Patent Dissolvent Lamps.*

The object of the invention appears to be, to render fluid, tallow, cocoa nut oil, (otherwise butter of cocoa,) and all other concrete oils, or fat, by conducting a considerable portion of the heat given out by the flame of the lamp into the tallow, &c. thus liquifying them, and causing them to flow, to the wick of the lamp, to be consumed like the naturally fluid oils. When tallow, or kitchen fat, is thus employed, the combustion is so perfect that a very rich and brilliant light is given out, unattended with the emission of any unpleasant odour or smoke.



a a are two solid bent metal rods that conduct the heat, received from the flame of the lamp, to the tallow contained in the reservoir *b*; the ends of these conductors are therefore made to descend to the bottom of the reservoir. *c c* are two apertures (with covers that screw on) made in the supply pipe, for the purpose of pouring in a small quantity of melted tallow upon lighting the lamp, after which, the heat from the combustion is conducted into the reservoir, and the supply of fluid tallow is uniformly kept up until it is all consumed.

From the circular given to us by the agent, on the occasion of our calling at his shop, we extract the following observations on the advantages attending the use of these lamps.

"To those acquainted with the superior combustible properties of *Tallow* and *Cocoa Nut Oil*, it is unnecessary to say more than that *these lamps effectually melt and burn, both*, and that the price of the latter, at the manufactory, is 2*s.* 6*d.* per gallon! but to others, to whom their good qualities are less known, it is necessary to state, that from the comparatively small portion of oxygen necessary to complete their combustion, the *total absence of smoke and smell is insured*, and the brilliancy of the flame is such as no lamp ever before produced, and nothing but the best gas light can equal.

"To families who kill their own meat, to inn-keepers, proprietors of cook shops, &c. a two-fold advantage will be found in the use of these lamps, as it is *not merely tallow that they burn, but grease of* *every description*, such as *dripping, pot skimmings, &c.* a pound of which, value about 3*d.* will continue, for full twelve hours, in a common-sized dissolvent argand burner, to yield light *equal to eight candles*, being no more than a farthing an hour!"

[*Register of the Arts.*

New Invented Crane.

IN the October number of Newton's Journal, he has given the subjoined account of a new invented crane. We shall, hereafter, obtain further particulars of its construction, and we greatly err in our judgment, if its operation will be found to justify the expectations which the present publication is calculated to excite. We may find an improved instrument, in which the power is more conveniently applied, than in those heretofore made, the friction may be lessened, and the obstruction from the rigidity of cords, or other causes, may be, in some measure, obviated; but should the effective power of men be increased, in the ratio represented, we must obtain some new mechanical power, acting upon new 'laws of nature;' perpetual motion will no longer be an impossible problem, and we shall 'be condemned to study again our experimental philosophy,' and rearrange all the machinery operated upon by the power of men. The following is Mr. Newton's account. [*Editor.*

"Mr. L. W. Wright, has just completed a crane for raising heavy bodies, which is constructed upon very different principles to any crane that we have before heard of. It is without either wheel or pinion, and acts by an extremely simple adaptation of wedges and levers. There is one extraordinary property, in this peculiar combination of mechanical powers, which appears to shake the validity of an old established axiom, that "power can only be increased at the expense of velocity," for this crane does actually raise heavy weights with less than half the power of the best constructed cranes heretofore used, and with the same, or even greater velocity.

"Mechanics have considered a certain general rule of power compared to velocity, to be established, which, if we are not mistaken, is, that *two men will raise 600 cwt. at the rate of ten feet per minute*, by any of the known simple combinations of the wheel and pinion, or other mechanical powers; or, in other words, that one man will constantly exert a power equal to 35lb. during the hours of daily labour, which, being multiplied by ten, the assumed power gained by the machinery, and allowing 1-7th for the friction, leaves about 300 cwt. per man; and in all cases where the machinery is so constructed as to increase the effect of the power exerted to raise the heavy body, the velocity, or space through which the heavy body moves, must, accordingly, diminish.

"Several of these cranes have been lately erected at the West India Docks, and it has been proved, that, while two men raise, (as above said,) 600 cwt. at the rate of ten feet per minute, by the ordinary cranes, two men, with the improved crane, will raise more than 1500 cwt. through the same distance, in a similar space of time.

"The application of the mechanical principles, on which this crane is constructed, is admitted, by all who have seen it, to be perfectly new, and its performance, in every respect, satisfactory. We are not at liberty to describe its construction, at present, as the patents for Scotland, Ireland, and other countries, are not yet complete, nor is the specification of the English patent, yet inrolled; but, as soon as the invention can safely be made public, we shall lay it before our readers."

PERKINS'S *Steam Engine.*

MR. PERKINS'S engine, erected at St. Catherine's Dock, has been, *occasionally*, at work, raising water, since our last notice, and, as we are informed, with all the effect desired. Mr. P. has now erected at his new factory, near Regent Square, Gray's Inn Road, a very complete engine, having two single stroke cylinders, connected together, both worked with high pressure steam.

The steam is admitted from the generator, through a very small induction aperture, at the lower part of the first cylinder, (which is a small one,) at a pressure, it is stated, of about one hundred atmospheres, and, when the piston has been forced up one eighth of its stroke, the induction aperture is closed. This volume of steam now expanding, drives the piston to the top of the cylinder, where an enlargement of the cylinder allows the steam to escape past the piston, and through a passage to the upper part of the larger cylinder, connected to it, where, acting with a diminished force, (say about ten atmospheres,) it drives the larger piston, to the bottom of its cylinder, and there escapes.

The two piston rods, being connected together, and the steam entering the two cylinders, at opposite ends, the two pistons mutually assist each other, in their ascent and descent; that is, the ascent of the smaller piston, lifts the larger one, and then the steam of diminished force, acting alike on the top of both pistons, forces them down; the induction aperture being now opened again, a volume of steam is admitted, as before, and thus the engine is continued in action, without any re-action of either of the pistons.

The specification of the last improvements, having been inrolled within a few days only, we have not been able to prepare the plates and description, but intend, at a very early period, to lay the subject fully before our readers.

[*Newton's Journal for Oct.*

On the Preparation of a Cheap and Durable Cement, or Stucco. By M. LASSAIGNE.

THE writer observes, that the cement or plaster, commonly used in France, (which consists of a mixture of chalk, and strong size) is objectionable, as being deficient in hardness, apt to chip or scale off, and unable to resist the rain. He proceeds to state, that a composition formed of slacked lime, mixed with 4 to 5-100 parts of alum, though dearer than the former, has been found preferable, on account of its adhering more firmly to the wall, and being better calculated to resist the inclemencies of the weather, which, he conceives, is owing to the alumine of the alum becoming incorporated with the lime.

Following the advice of M. Dulong, he has endeavoured to imitate this cement, on a more economical principle. To effect this, he has diluted slacked lime and white clay, with water, and after mixing, suffered them to blend together, and re-act upon each other for some time, at an ordinary degree of temperature. The proportions of the separate ingredients are 100 parts of quick lime, five of white clay, and two of yellow-ochre. The process is as follows:

The lime is first slacked with a small quantity of water, more of which is added by degrees, until the mixture is reduced to about the consistence of cream, the white clay is also diluted, and brought to a similar state, by being suffered to remain for some time in water, and the two solutions are then mixed carefully together.

This mixture is suffered to remain in casks, or tubs, for about twenty-four hours, care being taken to stir it from time to time. After the expiration of this period, the yellow-ochre is added, as a colouring, and it is then fit for use.

The parts of walls covered with this cement, which have been exposed, in the country, to the influence of the south west winds, and rain, for the space of two years, have lost none of their colour, nor can any portion of the plaster be rubbed off by the hands.

[*Bull. des Sciences.*

New mode of Copying Oil Paintings, by means of Lithography.

M. SENEFELDER, of Munich, the well known lithographic artist, has invented a new process of printing coloured designs, so as perfectly to resemble oil paintings. The plate from which the impression is taken, resembles a species of mosaick, composed of different colours, in a soft state. The basis of these colours, consists of wax and oil, which are, probably, rendered soluble, by means of caustic potash. To obtain 100 copies, it is necessary that this stratum of colours should be, at least, a line in thickness; for a thousand, one inch, and for any other number, in proportion.

The inventor assures us, that the composition of the plate, does not occupy more time than a common oil painting on canvass. No particular talent is requisite, for the drawing. The process of the impression is, also, attended with but little difficulty. The paper, after being moistened, is laid upon the plate, and, by means of a slight pressure, a most beautiful copy is obtained, which is then carefully spread out upon canvass, covered with a strong drying varnish. The picture is, afterwards, washed over with alum water, in order to render its colours as durable as those of paintings in oil.

[*ib.*

THE ARTISAN.—No. 4.

Remarks upon Pumps for raising Water. By the Editor.

We have, at different times, received communications, on the construction of pumps, and other machines for raising water, which have often served to manifest a deficiency in, or a total want of knowledge of their action. Among the numerous errors which prevail upon this subject, the idea, that the pressure of the atmosphere, diminishes the power necessary to raise water in the common pump, appears to be the most general. We have now before us, a letter received from a gentleman, in South Carolina, some weeks since, whose plan is, to raise water from deep wells, say, of 90 feet, by successive pumps. He proposes, that a pump of 30 feet in length, shall be placed at the bottom of the well, to raise the water into a reservoir, fixed to receive it, near the head of this pump; that the bottom of a second pump shall stand in this receiver, and that a third be similarly arranged, to elevate the water to the surface of the ground; and that the rods, from these pumps, be of sufficient length, to be attached to a common handle, at the top, to work them simultaneously. Three pumps, so arranged, will, he calculates, save, at least, the necessity of lifting a column of water, of three times 28, or 84 feet in length, and that the labour, therefore, would be so reduced, that the weight of the rods, the friction, and a column of water, of 6 feet in height, would, alone, require to be raised.

This may serve as a fair sample of numerous proposed improvements, coming, in many instances, from persons, not deficient in general intelligence; the subject is, therefore, worthy of particular attention, as such errors frequently lead to much loss, both in time and money. We will, hereafter, endeavour to place it in a clear light, but, at present, shall only state such facts and principles, as we think can be made plain to every attentive reader.

To the correspondent alluded to, we will say, that his plan, although novel to him, is not so to those conversant with the subject. Pumps made in the way proposed, have been constructed, and are figured in the books. To all those who imagine, that in pumping water, they can derive any aid from atmospheric pressure, we will say, that they are altogether heterodox. We cannot, by any conjuration, or by any cunning construction of our machinery, raise a hundred weight of water, to the height of ten feet, without the application of as much power as is requisite to raise a stone of the same weight, to the same height; *the atmosphere* will assist us just as little, in one case, as in the other; and, if we wish to raise double the quantity to the same height, or the same quantity to double the height, we must employ double the power, or, its equivalent, double the time.

The three pumps, made, as above stated, were so made, not to lessen the power required to raise the water, but to obviate some practical difficulties. A pump tree, of wood, ninety, or a hundred feet in length, is very liable to burst, by the weight of the column of water contained in it; and, from a similar cause, the valves are raised with difficulty; by dividing the pump into three parts, there will be a corresponding diminution, in this pressure; but, there will also be a greatly increased load, from the amount of pump rod; and, also, an increased number of valves, to open, and to become deranged. We did not, however, set out to discuss the merit of this kind of pump, or of any other, but to furnish some hydraulical didactics.

Something may, undoubtedly, be accomplished, in the improvement of pumps; but, we are just as well prepared to credit the accounts of the discovery of perpetual motion, as those which are so frequently given, of hydraulic machines, enabling two or three men to perform as much work, as double that number, by the machinery now known. It is, certainly, not possible to procure, with the same power, one-third more water than we now can, with our best pumps. Nearly, or quite, all that is to be hoped for, is to lessen friction, to remove obstructions to the free passage of the water through the valves, and to cause them to open and close, without loss of time, or of water.

With regard to the action of the atmosphere, we will merely remark, that we sometimes, and, indeed, generally, construct our pumps so as to bring it into operation; but, such is the nature of the aid which we derive from it, that, for every pound of water which it forces up by its pressure, we must force a pound of air, to the same height; and, if we choose to lengthen our pump rod, so as to allow the piston to be below the surface of the water in the well, we may dismiss the atmosphere from our service; and, were it not for the necessity of breathing whilst we are pumping, we should not, by so doing, lessen the facility with which water would be obtained.

Queries and Replies, respecting the Rise of Water, in certain situations.

The subjoined queries and replies, appeared in the National Gazette, of this city, a few weeks since, and perhaps our readers may not think them unworthy of preservation, in our pages. Who cracked the nuts, is a question which we might answer, but this is a point of little importance, provided they be well cracked; and that they are so, is the opinion of some, who are able to judge in such nice cases. EDITOR.

A Nut for the Philosophers.

The water, in the lower part of the city of New Brunswick, is what is commonly called *brackish water;* it is unpleasant to the taste, and, in the opinion of some, injurious to health. This has induced a few gentlemen in that part of the city, to seek for a more pure supply, by the modern practice of *boring for water.* They selected their spot, perforated the earth, to the depth of two hundred and twenty feet, and then inserted, in the perforation, a tube of one hundred feet in length, reaching down to a body of solid rock, called the *red shell rock.* The upper end of the tube is in-closed in a wooden pent-stock, from which there issues a continual stream of water, of (I should think, without having measured it) from half a gallon to a gallon, by the minute.

The tide regularly ebbs and flows, in the Raritan, and rises at this place, about six feet, and the surface of the ground, where the perforation is made, is elevated about eight feet above the high water mark. In this situation, the stream issuing from the pent-stock, corresponds exactly, and continually, with the rising and falling of the tide, in the Raritan. When the tide is at ebb, the stream is small; when it rises, the stream increases, and, when it is high, the stream is at its greatest flow, varying, as about one to three, at the different states of the tide.

Now, the rising of the water, in the tube, is, itself, a phenomenon, not easily explained, upon the known principles of hydraulics. Can it come from the river, when the point of discharge is from eight to fourteen feet above the surface of the water, in the river? And, if it should be attempted to account for it, by supposing that it is conducted from higher grounds, by dipping strata of rock, or clay, or other substance impervious to water, and that, when such strata are perforated, at any given depth, the water pent up between them, will rise as high as its surface, in that confined state; does not this exclude the possibility of its having any communication with the river, or being in any way affected by it?

The fact is, as above stated. Can it be accounted for, upon any settled principle of philosophy? If water can be had by boring, in all situations, it is one of the greatest discoveries in modern times; and, if it has a tide in the bowels of the earth, it presents a phenomenon, unknown to philosophers, both of ancient and modern times.

X.

Soft-Shelled Almonds.

Without claiming the character of a philosopher, excepting in the original acceptation of the term, I will attempt to crack the nut held out to the fraternity, in the Gazette of the 12th instant, in the article headed *A Nut for the Philosophers*.

The theory, or, rather, the assumption, that water may be obtained, and made to flow above the surface, in all situations, is, I presume, intended to be sustained by the facts adduced by X. respecting the flow of water, through a tube, elevated eight feet above the Raritan, at Brunswick, in New Jersey; much stronger facts than those stated, will, however, be necessary, before the received theory will require additional support.

We are told, that the rising of the water in the tube, is a phenomenon not easily explained, upon the known principles of hydraulics; I think differently, and, at all events, do not expect to obtain a clear explanation upon *unknown* principles. That the water may be conducted from a higher situation, under "dipping strata of rock, or of clay," appears to be admitted, as, also, that, under such a state of things, by perforating the confining stratum, a flow of water would be obtained; but, in the case in question, we are told, that the flow of water from the tube, corresponds with the rise and fall of the tide, in the river, increasing in quantity, as it rises, and decreasing as it falls; and this, we suppose, is the nut to be cracked. We are asked, whether the admission, that the water, flowing through the tube, is derived from a higher source, does not exclude the possibility of its having any communication with the river, or being, in any way, affected by it? It is my design to answer this question in the negative, and to show that its connexion with the river, is, probably, the cause of the phenomenon.

If water, from any source, be conducted through a tube, into the bottom of an empty reservoir, it will flow with a velocity proportioned to the height of the source; but, as the reservoir fills, the column of water, as it rises above the orifice, will press upon it, and retard the discharge, and that, in exact proportion to its elevation. Were water allowed to flow through a small opening in the tube, above the top of the reservoir, the escape through this second opening, would be accelerated, as the water increased in the reservoir, and retarded, as it was diminished. Now, suppose the vein of water which was reached in boring, to make its final exit, in the bed of the river; the arrangement would be precisely similar to that which I have supposed, and the difference, in the quantity discharged, would necessarily result from the rise and fall of the tide. J.

On the rise of Water on the Kenhawa.

Observing, in the Gazette of the 12th instant, an article headed, "A Nut for the Philosophers," giving a description of the result of the procuring of water, in the city of New Brunswick, by boring, and the influence it is supposed the tide has, on the running of the fountain,—the writer of this, would beg leave to offer, to the philosophers, a nut quite as difficult to crack, if not more so. On the margin of the Kenhawa river, there are many borings for salt-water. The plan of obtaining it, is, by sinking a hollow sycamore, cut to a length so as to reach above high water, when placed on end, so as to exclude the fresh water; the boring being completed, a tube is inserted, the salt-water rises to precisely the level of the surface of the water in the river, and continues so: should the river rise to thirty feet, and sink to three, the salt water is equal with its surface, without variation. A SUBSCRIBER.

A Nut from the Kenhawa.

Having, on attempting to crack the nut from the Raritan, found it to yield easily to teeth, which are, themselves, of a brittle texture, I have determined to essay the Kenhawa nut, although *A Subscriber* appears apprehensive, that it may be found harder than the former; let those who are judges in such matters, examine, and tell whether I have not penetrated the shell, and exposed the kernel.

Admitting the phenomenon of the rise of salt-water, through a bored trunk, on the margin of the river, to be as stated, that is, that it will always rise to the level of the water in the river—however that level may vary,—it would follow, that the beds of the rock-salt, from which the springs are supplied, derive the water, by which their solution is effected, through fissures from the bed of the river. Under such an arrangement, the water would always rise to the height of the source whence it was derived.

Although I have attempted this second nut, I beg leave to state, that I do not intend to undertake the business of nut-cracker, to the community; I have now some on hand, which have resisted all my efforts, and shall be happy to obtain assistance from some one, whose *masseters* are stronger than my own. J.

Notice of some recent Improvements and Discoveries.

Extract from a letter from a person in Great Britain, dated September 30, 1827, to a gentleman of this city.*

"You have probably heard of Mr. Herschel and Mr. Blairs' invention of *fluid object glasses*, or fluids to be used instead of object glasses, in achromatic telescopes. The difficulty of finding a fluid that continued perfectly homogeneous, and some other difficulties about corroding the glass, prevented the perfecting of this suggestion for a considerable time; but at last, a telescope has been perfected on this principle, by Mr. Barrow, of Woolwich. His invention, is the use of sulphate of carbon for the purpose; and further, he has found means which Herschel could not fully explain to me, of diminishing, by one-half, the focal length.

Another suggestion of Herschel's, will probably lead to a great result. He long since imagined, that air, or other gases, compressed, might be used in steam engines instead of steam, which with increased power, might require less room and less fuel in the production and support. An engine has been constructed for an experiment, by some gentlemen of Edinburgh, with compressed air for the power. It was expected to do the work of a 30 horse power engine, but does the work of only 20 horses. The constructor thinks he sees the defect in the machinery, which occasions the loss of power, and that he can remedy it. If so—and if . . . . (several *ifs*, which Herschel stated to me, which I have not time here to repeat in detail,) it will be a great improvement, with amazing consequences."

"Dr. Brewster has copied for me, in his last letter, a passage from a letter he has lately received from a friend in Calcutta. Stating the extraordinary fact, that in our new territories, there is a plant, from whose stem, when divided, there issues a copious vegetable spring 'of limpid and wholesome water. The natives know this wonder quite well, and in consequence, you rarely meet with an entire plant. The shrub in question, is to us new, and a non-descript.'"

"'The above is an extract,' says Dr. Brewster, 'from a letter of Dr. Wallick's, an eminent botanist, and the fact is undoubted.'"

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* The subjects noticed, have reached us in the Journals recently received from England, and may hereafter be presented to our readers more in detail.

List of Patents granted in the United States, from September 14th to October 25th, 1826.

By the attention of S. A. Elliot, Esq. of the Patent office, we are enabled to complete our list of American Patents in those parts which were defective, and shall, in the succeeding numbers, bring them up to the present period. The circumstances which have prevented their regular insertion, were stated in page 429 of our third volume.

FOR INVENTIONS AND IMPROVEMENTS.

In the printing press, called the New England printing press; Edward Cooper, Richmond, Virginia, Sept. 14th, 1826.

In the mode of sawing circular timber, or work for felloes of carriages; Benjamin Overman, Greensboro', North Carolina, Sept. 15th.

In the wheels for propelling steam boats, and for other uses; John James Giraud, Baltimore, Sep. 15th.

In rail-ways, called the portable endless rail-way; Jeremiah Price, New-York, Sep. 15th.

In the machine for manufacturing wrought nails, spikes, &c.; Joseph Krauser, Philadelphia, Sep. 23.

In the engine for throwing water for the extinguishment of fires; George Shalk and William Tintoff, Lebanon, Pa., Sep. 23.

In the wool-carding machine; James H. Arnold, Belmont, Ohio, Sep. 25.

In the machine for raising earth, mud, &c.; called the sub-marine excavator; Samuel Collins, New-York, Sep. 26.

In the mode of applying anthracite coal to the generating of steam; Daniel Collings and James D. Gallup, Wilkesbarre, Luzerne county, Pa., Oct. 12.

In the grist mill; Moses Mendenhall, Greensboro', Guilford county, N. Carolina, Oct. 20.

In bells; Henry Tyler, Utica, New-York, Oct. 20.

In the method of drawing water from wells, patented by him on the 2d day of Nov. 1823; Elijah Willard, Egremont, Mass. Oct. 23.

In making and constructing cellars, vaults, and magazines, in such manner as to prevent the tide or spring-water from entering in any way; Henry Hallack, New-York, Oct. 24.

In the manufacture of bridles; Daniel H. Read, New-York, Oct. 24.

In the machine for shelling corn; Elijah Russell, Greensboro', N. Carolina, Oct. 24.

In the horse saw-mill; Solomon R. Johnson, New-York, Oct. 25.

In the method of discharging cannon and ship guns; Henry Whitcomb, Adams, Jefferson county, New-York, Oct. 25.

In the bark-mill; Cotton Foss, Madison, Ohio, Oct. 25.

Patents granted in 1827, *from January 3d to February 15th.*

In rolling iron; Abraham S. Valentine, Bellefont, Centre county, Penn., Jan. 3.

In the water gate for penstocks, or flumes for mills; Henry Potes, Christiansburg, Montgomery county, Virginia, Jan. 9.

In making hoes, by rolling out cast or any other steel; Chauncey Bulkley, Colchester, Connecticut, Jan. 10.

In making irons for planes; and jointers, double and single, and of all sizes and shapes, by rolling together the steel; Charles E. West, Colchester, Connecticut, Jan. 10.

In the water-proof mortar or cement, stated by him to be from a mineral, not known or used for that purpose before his application; his former patent on this subject, dated on the 11th of January, 1826, being cancelled on account of an incorrect specification; Simeon Guilford, Washington, D. C. Jan. 16.

In the grist mill; Anthony Bencine, Caswell county, N. Carolina, Jan. 16.

In the plough for planting corn, &c.; Hermon Russell, Litchfield, Lincoln county, Maine, Jan. 16.

In the construction of stills, for the distillation of rum, whiskey, essences, and other spirituous liquors and cordials; Edmund Capen, Boston, Mass. Jan. 17.

Of a machine, called the bearded chisel mortising machine; Silas Metcalf, Wilmington, Vermont, Jan. 17.

In economizing the charring of wood, and the more effectual procuring of inflammable gas for working pneumatic gas engines, and other useful purposes, by a new combination of apparatus or machinery; Samuel I. Jones, Philadelphia, Jan. 17.

In the method of heating ovens, rooms, &c.; Michael B. Portiaux, Richmond, Va. Jan. 17.

In the mode of making pipes, tubes and gutters, of all kinds, for the conveyance of water, above or below the surface of the earth, from clay or argillaceous earth, by machines and various operations; Joseph Putman, Salem, Mass. Jan. 17.

In the grist mill; William Benbow, Guilford county, N. C., Jan. 19.

In the mode of generating steam; Levi Silliman, Albany, New York, Jan. 19.

In stirrup irons; Daniel Powles, Baltimore, Jan. 26.

In bedstead joints and sacking bottoms; Daniel Powles, Baltimore, Jan. 26.

In the press for tobacco, cotton, and other purposes; Benjamin R. Curtis, Richmond, Va., Jan. 29.

In the machine for planking hats; Robert Bacon, Boston, Jan. 31.

In the machine for tonguing and jointing boards; Elijah B. Clark, Damascus, Penn. Jan. 31.

In the lamp apparatus, for heating and boiling water, and other economical purposes; Thomas Green Fessenden, Boston, Jan. 31.

In the principles of machines for navigation; John James Giraud, Baltimore, Jan. 31.

In pumps, called "the Mariner's Friend;" James Robinson and Luke Shaw, Bath, Maine, Feb. 1.

In the construction of pedestal feet for andirons; Edmund Smylie, New-York, Feb. 1.

In the gun-lock; Simon Cromwell, Edgecomb, Maine, Feb. 3.

In the grist mill; Edward Newnam, Guilford county, N. C. Feb. 6.

In the machine for cutting straw; Thomas Benbow, Guilford county, N. C. Feb. 6.

In the horizontal wind wheel or wind mill; Thomas P. Jones, New-Castle, Delaware, Feb. 6.

In the machine for shelling corn; Edward Newnam, Guilford county, N. C. Feb. 7.

In steam boilers, for using anthracite coal; John Barker, Baltimore, Feb. 7.

In the chair; Jacob Daley, Baltimore, Feb. 9.

In machinery for pressing bricks; Alfred B. Crossman, Huntingdon, Suffolk county, New-York, Feb. 9.

In the horizontal cast iron paint mill; Origen Packard, Wilmington, Vermont, Feb. 12.

In opening and shutting the water gate for mills, &c.; Origen Packard, Wilmington, Vermont, Feb. 12.

In burning lime and brick, and boiling kettles; Solomon Hill, New-Milford, Connecticut, Feb. 12.

In the rocking churn; John G. Philip, Kinderhook, New-York, Feb. 15.

FRENCH PATENTS,

Granted in the Fourth Quarter of 1826.

Lequart, Paris; for mouldings in brass upon wood, for mirror frames, shop-fronts, &c.—10 years.

Leriche, M. J. Paris; for the application of the machine used by the ancients, called *catapulle*, for extracting, clearing and levelling land.—10 years.

Galy-Cazalet, Paris; for an aerostatic lamp and candlestick, with a match and two combustibles.—10 years.

Bouchy, J. V. Paris; for a machine to manufacture Paris sprigs or points.—15 years.

Avril, M. Paris; for a three wheeled carriage, called a *triolet.*—5 years.

Perpigna, A. Paris; for an improved method of vaporizing water. —15 years.

Delamare, J. P. senr. Rouen; for improvements in the fabrication of orange mineral.—10 years.

Lacote, P. R. and Carulli, F. Paris; for the invention of a guitar with ten strings, called the *decacorde.*—5 years.

Paturle, Lupin and Co. and Seydoux, C. and A. Paris; for a machine called *vaudoise*, for combing wool.—15 years.

Cordier, and Daulle, Messrs. Paris; for a wool combing machine. —5 years.

Brierq, P. Lyon; for a stuff to be used instead of furs, of various patterns, called *brierque*, and for his processes for dying stuffs.—5 years.

Gounon, E. Eause; for a continued distilling apparatus by steam. —15 years.

Corout, A. St. Julien-Molin-Molette; for a loom for weaving silk, cotton, wool, &c.—10 years.

Croisat, F. Paris; for a process of making flowers in hair and silk. —5 years.

Hall, E. Paris; for a new fulling machine.—10 years.

Benoist, Mrs. Paris; for a close stool with an absorbing cover, for water closets.—10 years.

Stuckens, P. G. Paris; for an improvement in the French horn.—5 years.

L'Epine, M. Paris; for a gas generating lamp, called the *Gazolampo.*—10 years.

Larguier, P. St. Roman; for a new application of steam for heating the water used in silk spinning.—5 years.

Joseph, S. London; for new machinery to be adapted to screw presses, to increase their force.—5 years.

Poole, M. London; for a method of tanning hides, by employing the pressure of the atmospheric air.—15 years.

Wilks, J. B. London; for improvements in the evaporization of water destined for steam engines, &c.—15 years.

Pape, Mr. Paris; for a machine for piercing wood for veneering, and for turning the feet and bases of pianos, and other furniture.—10 years.

Berard, P. Lunel; for an apparatus for essaying the spirit of wine. —5 years.

Debergue, L. N. Paris; for a recipient for transporting gas.—15 years.

Poulliot, J. J. Paris; for a pneumatic regulator applicable to hydrogen gas apparatus, and fire machines.—5 years.

Leprince and Poulain, Messrs. Paris; for improvements in a cotton flatting mill.—5 years.

Hemtault, E. Paris; for a circular drag and appendages.—10 years.

Galy-Cazalat, A. Perpignan; for the invention of a percussion gun, and cartridge case complete.—10 years.

NOTICES.

The fact of Mr. Harding's printing office having been destroyed by fire, renders all apology for the delay of this number unnecessary.

The article on extracting the fecula from starch, shall appear, as soon as the requisite engravings can be finished.

Our notice of the "Mechanics' Assistant," which has been so long delayed, is again forced out, by the accident above named: we hope that a similar reason will not prevent its appearance in our next.

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